SCIENCE DIGEST

Adventure in Science & Discovery

OCTOBER 1969 · 50 CENTS ICD

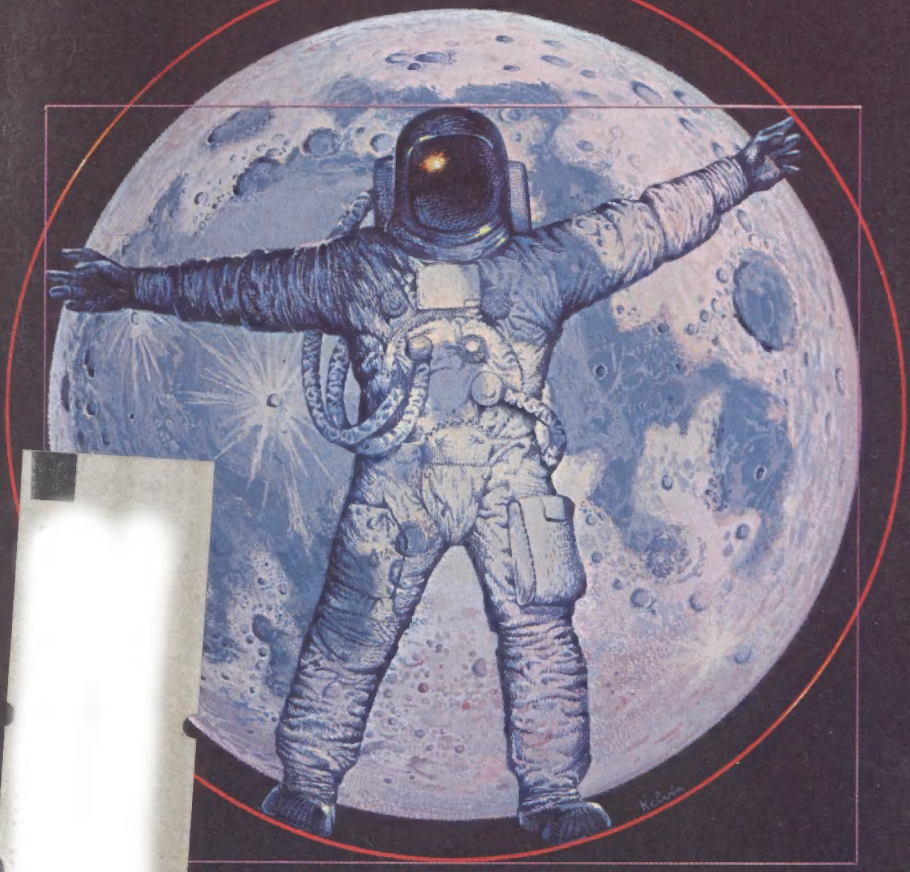
SPECIAL SECTION

THE MOON AND SPACE

Isaac Asimov: Why we must explore them

The strange moon formations here on earth

Moon Madness—fact or fiction?

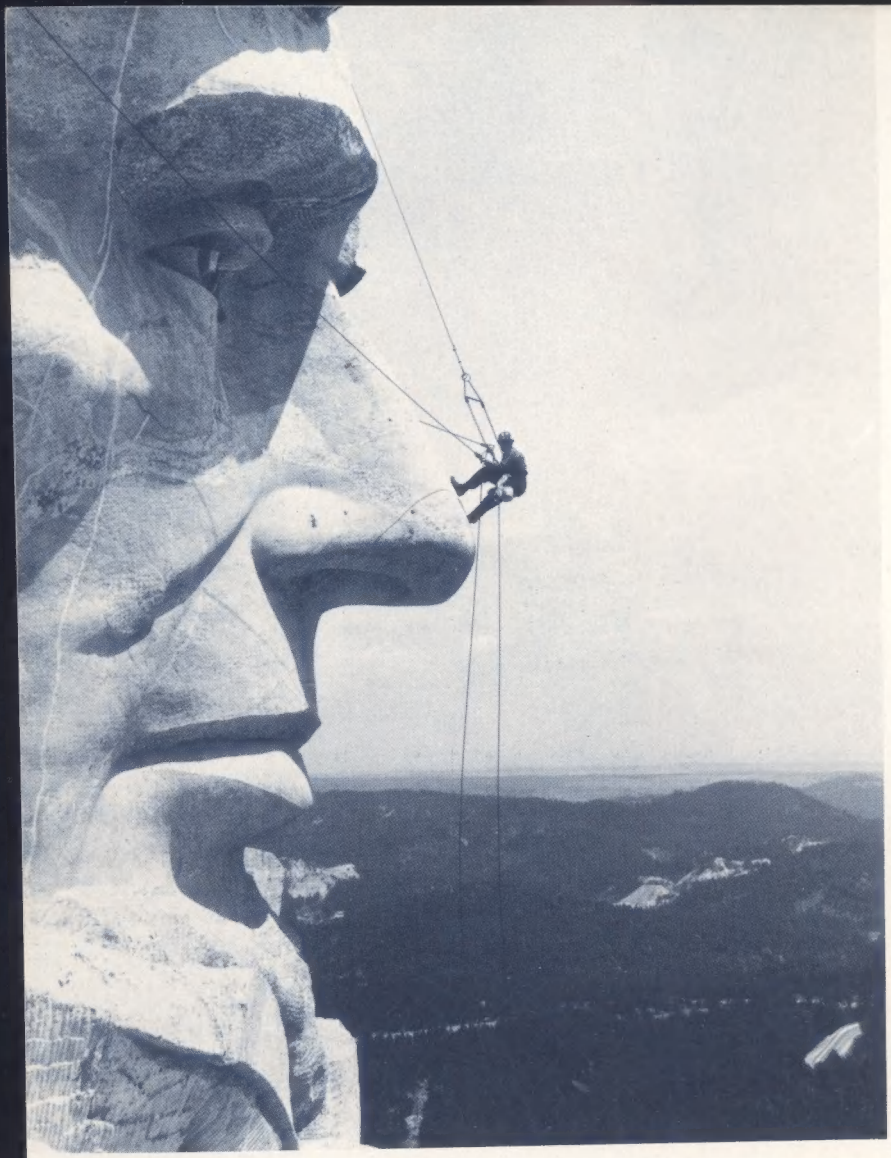


computing thermometer YOU can build

Weird world of night creatures

Deformed babies and LSD

New hope for diabetics

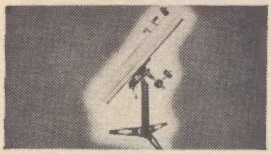


Abe's maintenance man

LIKE an insect on a thread, the Mount Rushmore sculpture specialist works his way down the features of Abraham Lincoln. He is looking for damaging cracks in the stone which he will fill with a mixture of linseed oil, granite dust and white lead. The sculpture is one of four created out of the mountain in 1941 by sculptor Gutzon Borglum.

KEEP PACE WITH SPACE AGE! SEE MOON SHOTS—LANDINGS, SPACE FLIGHTS, CLOSE-UP!

AMAZING SCIENCE BUYS
for FUN, STUDY or PROFIT



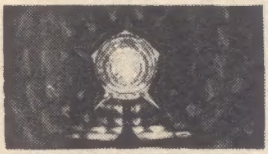
SUPER 6" SPACE CONQUEROR

Share the wonders of space exploration. Features aluminized & overcoated 6" f/8 ground and polished pyrex parabolic mirror accurate to ¼ wave, 48 F.L. 6X achromatic finder scope, 4 eyepieces—48X Kellner, ½" 96X & ¼" 192X Ramsdens, Barlow to double or triple power—rack & pinion focusing mount, 47-¾" aluminum tube. Electric clock drive w/manual slow-motion control. Setting circles. Heavy-duty equatorial mount. Pedestal base. Compares to $295—$350 models.

Stock No. 85,086AD .$239.50 FOB

4½" REFLECTOR TELESCOPE

No. 85,105AD .....$94.50 FOB
No. 85,050AD 3" .....$29.95 Ppd.



ROTATING MULTICOLORED LIGHT

Dazzling colors stream endlessly from constantly rotating light. Facetted, transparent globe has louvered drum inside with red, green, blue & yellow stars. Bulb heat rotates drum which projects flickering star points on walls, ceilings, etc. while individual globe facets present constantly changing array of brilliant colors. 9¾" star-approx. 12" high on bell-shaped base. Surprisingly light. Easily placed on table, TV, fireplace—even top of Christmas tree or other display.

Stock No. 71,000AD...$6.00 Ppd.

WATER CLIMBS UP HILL!

Amaze your friends - loads of fun - perfect for Science Fair. Water actually flows up side of glass & siphons freely into other container. To stop flow - cut with scissors - watch it snap back. Secret's in special additive with long molecular structure - req. only ½ tsp. to glass. Friction reducing additive has all kinds of industrial, agricultural, experimental uses - a pinch even makes gold fish slide thru water faster. 3 oz. can enough for 84 pints of water.

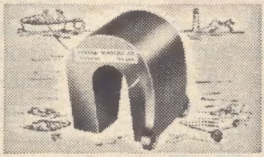
Stock No. 41,086AD ..$2.00 Ppd.

ENCAPSULATED LIQUID CRYSTALS

Amazing new development—appear like liquids but have orderly molecular structures similar to solids. Solutions contained in tiny (20-30 microns) capsules coated onto sides of six 6" x 12" Mylar sheets with 6 diff. temp. ranges. Surface changes color according to temp.-cover 66° to 120°F (19°-49°C). Use for precise measurements, find hot spots, structural defects, study radiation, test conductivity, etc. No mess. No contamination. Easy to handle. Use indefinitely. Instruct., color-temp. curves.

Stock No. 71,143AD $10.00 Ppd.

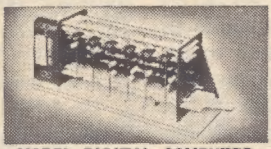
EXPERIMENTERS KIT -
same but 4" x 6" sheets
Stock No. 60,756AD ..$4.00 Ppd.



"FISH" WITH A MAGNET

Go treasure hunting on the bottom! Fascinating fun & sometimes profitable! Tie a line to our 5-lb. Magnet—drop it overboard in bay, river lake or ocean. Troll it along bottom—your "treasure" haul can be outboard motors, anchors, other metal valuables. 5-lb. Magnet is war surplus—Alnico V Type—Gov't cost $50. Lifts over 150 lbs.

Stock No. 70,571AD...$14.00 Ppd.
3½"-lb. MAGNET (40 lbs.)
Stock No. 70,570AD...$8.75 Ppd.
7½ lb. MAGNET (175 lbs.)
Stock No. 70,572AD..$18.75 Ppd.



MODEL DIGITAL COMPUTER

Solve problems, teach logic, play games with miniature version of giant electronic brains! Adds, subtracts, multiplies, shifts, complements, carries, memorizes. Colored plastic parts easily assembled, 12"x 3½"x4¾". Incld. step-by-step assembly diagrams, 32-p. instruction book covering operation, computer language (binary system) programming, problems & 15 experiments.

Stock No. 70,683AD ..$5.98 Ppd.

ANALOG COMPUTER KIT
Stock No. 70,341AD...$18.95 Ppd.

ELECTRONIC PROJECTS!

Build 56 electronic marvels in minutes—that actually work! Simply match symbols of amazing new solid state building blocks with those in easy-to-follow diagrams. Presto—instant radios, organs, alarms, etc. No soldering, wiring, tools. Magnetic connectors hold see-thru blocks containing proper components in place. Safe. Easy. Unique new fun-way to learn electronics. Requires ordinary 9V transistor battery (not incl.)

Stock No. 71,178AD..$33.50 Ppd.
20 PROJECT KIT
Stock No. 71,177AD..$12.00 Ppd.
100 PROJECT KIT
Stock No. 71,179AD.$200.00 Ppd.

GIANT WEATHER BALLOONS

"Balls of fun" for kids, traffic stoppers for stores, terrific for amateur meteorologists. Create a neighborhood sensation. Great backyard fun. Exciting beach attraction. Amateur meteorologists use to measure cloud heights, wind speed, and temp. Made of heavy duty neoprene. Inflate with vacuum cleaner or auto air hose; or locally available helium for high rise.

(8' Diameter)
Stock No. 60,568AD ..$2.00 Ppd.
(16' Diameter)
Stock No. 60,632AD ..$7.00 Ppd.

GIANT FREE CATALOG

148 Pages! More than 4,000 UNUSUAL BARGAINS!

Completely new. Huge selection of telescopes, microscopes, binoculars, magnets, magnifiers, lenses, prisms, Science Fair items, kits, parts. Thousands of components - accessories of all descriptions. Many hard-to-find surplus values. 100's of charts, illustrations, diagrams. A veritable treasure house of optical, science and math buys at terrific savings. Write for Free Catalog "AD." EDMUND, 300 Edscorp Bldg., Barrington, New Jersey 08007.

Name _____
Address _____
City _____
State _____ Zip _____

ORDER BY STOCK NUMBER • SEND CHECK OR MONEY ORDER • MONEY-BACK GUARANTEE

EDMUND SCIENTIFIC CO. 300 EDSCORP BUILDING BARRINGTON, NEW JERSEY 08007

"THE WHOLE THING is a fake," said the banker member of our group as we watched the still-unbelievable moon landing on TV that night of July 20. He was deadly serious. "It's a government trick. They shot that whole thing out on the Nevada flats last spring and now they're foisting it off on us so they can boost our taxes again without getting any squawks." He really thinks that Apollo 11 was rigged to g o u g e him, personally, and the American public incidentally. Actually, that particular chap isn't alone.

THIS MONTH

But he'd squawk whether the money was going for space exploration or for welfare. Most objectors to the prospects of our exciting plunge into the firmament believe quite sincerely, and with far more sincere and generous conviction, that the billions of space dollars would be far better spent righting the social wrongs and inequities on our own trouble-beset planet. "Why explore space anyhow?"

It's a good question, and there are many answers to it. To get some of the best of them, from one of the best minds in the country, we asked Dr. Isaac Asimov if he'd be able to take time from this month's quota of books to provide such answers. Turns out, he'd already done it, but was good enough to grant permission for us to use his material. It's on page 8, and we've added two other articles—one on some remarkable new findings about the similarities between the moon and the earth's geology; another on the truth vs. the fiction about "moon madness." We hope you'll find it as engrossing as we did in pulling it together.—*RFD*

SCIENCE

RICHARD F. DEMPEWOLFF, Editor
DAVID COLEMAN, Managing Editor
BARBARA FORD, Assistant Editor
JERRY GREER FALES, Assistant Editor
GEORGE V. KELVIN, Art Director
JOHN M. MITCHELL, School Dept.

Contributing Editors

ISAAC ASIMOV, Ph.D., Biochemistry
JOSEPH D. WASSERSUG, M.D., Medicine
JEANNE REINERT, General Science
DANIEL COHEN, General Science
BRUCE FRISCH, General Science
FLORA SCHREIBER, Psychiatry
MELVIN HERMAN, Psychiatry
DR. ARTHUR S. FREESE, Technology
STACY V. JONES, Inventions
ARTHUR SNIDER, Medicine
M. & J. DAUGHERTY, Quiz

Editorial and general offices:
575 Lexington Ave., New York, N.Y. 10022

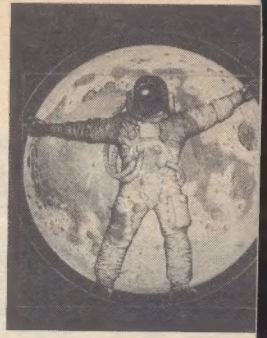
Subscription offices:
250 West 55th Street, New York, N.Y. 10019

Advertising offices:
JACK KEARTON, Advertising Director
575 Lexington Ave., New York, N.Y. 10022
Phone 212 MU 8-8500

Chicago: 520 N. Michigan Ave. 527-2400, J. Nielan, Manager. Detroit: General Motors Bldg., TRinity 5-8711, Charles Sullivan, Manager. Cleveland: 20310 Chagrin Blvd., Shaker Heights, 283-7788, William Leavenworth, Manager. Los Angeles: 601 No. Vermont, 666-6263, Al Perry, Manager.

SCIENCE DIGEST is published monthly by The Hearst Corporation, 959 Eighth Avenue, New York, N.Y., 10019. RICHARD E. BERLIN, *President;* GEORGE HEARST, *V-Pres.;* RICHARD E. DEEMS, *President of Magazines;* JOHN R. MILLER, *Executive V-Pres., Magazines;* WILLIAM S. CAMPBELL, *V-Pres., Magazines;* ALBERT A. RACHOI, *V-Pres. and Director of Circulation;* RAYMOND J. PETERSEN, *Senior V-Pres of Magazines;* FRANK MASSI, *Executive V-Pres. and Treas.;* HARVEY L. LIPTON, *Sec.*

DIGEST®



Man has gone to the moon and returned safely to the cheers of millions and the questionings of others. To answer some of those questions, to inform you how the moon is like the earth and to entertain with some interesting moon lore, we are presenting a three-part cover special on the moon. See page 7.

Painting by George Kelvin

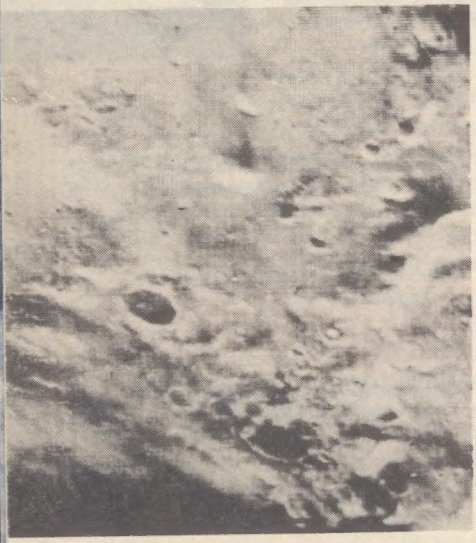
OCTOBER • 1969 Vol. 66, No. 4

CONTENTS

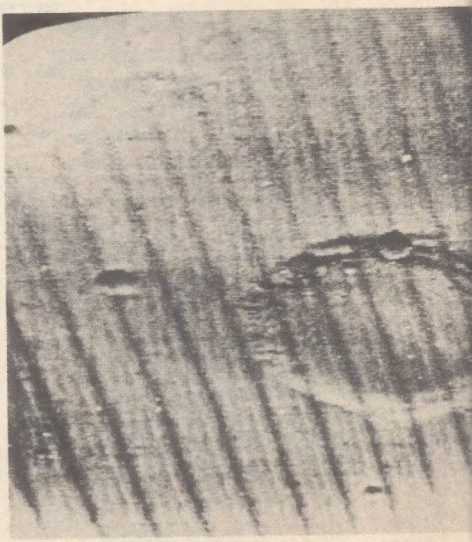
DEPARTMENTS

SUBSCRIPTION PRICES U.S.A. and Possessions, $5.00 for one year; $9.00 for two years; $13.00 for three years. Canada, add 75¢ for each year. All other countries, add $1.00 for each year. Special Teachers' and Students' rates available through SCIENCE DIGEST School Plan. 25¢ a copy, minimum order 10 copies per month. Write to: SCIENCE DIGEST School Dept., at address below. Subscription Service: Mail all subscription orders, changes of address, correspondence concerning subscriptions, and Postmaster notices of undeliverable copies to SCIENCE DIGEST, Box No. 654, New York, N. Y. 10019. Please enclose your latest address label for quickest service when writing about your subscription.—Second-class postage paid at New York, N. Y., and at additional mailing offices. Microfilmed copies of SCIENCE DIGEST are available through University Microfilms Library Services, Xerox Corp., Ann Arbor, Mich. 48106. SCIENCE DIGEST is indexed in READERS' GUIDE TO PERIODICAL LITERATURE and CURRENT CONTENTS under Education. Articles are indexed in SCIENCE DIGEST for six-month periods every January and July. Printed in the U.S.A. Contributions must be accompanied by a self-addressed and stamped envelope.

NEWS IN BRIEF/Bulletins at press time



South Polar Cap of Mars from 2,500 miles.



UPI

Moonlike crater on Mars, shot by Mariner 6.

MARINER PICTURES OF MARS proved to be everything and more than scientists had hoped for. The Mariner 6 shots, from 2,200 miles above the Martian terrain (above), were backstopped by Mariner 7, sailing along through space five days behind the former. The photographic gold mine produced some surprises and precipitated more questions than they answered. The surface proved to be more moonlike than expected, spattered with impact craters, like the 10-mile-wide one above, with small craters on its rim. They were a lot more eroded than those on the moon, however, due, scientists believe, to action of the thin atmosphere. The experts will be arguing for a long time about whether the large polar ice caps are composed of carbon dioxide "dry-ice" crystals or of water ice. Data provided some speculation about the existence of organic material along the rim of the ice caps, but none of the pictures showed any evidence of the once-famous Martian "canals."

(Continued on page 6)

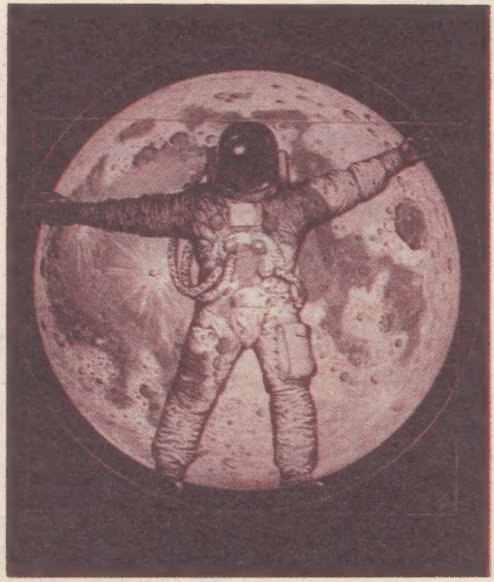
JACQUES PICCARD'S BEN FRANKLIN SUBMARINE surfaced on August 14, after drifting submerged in the Gulf Stream for 30 days, covering 1,500 miles at an average speed of two knots. The 130-ton research vessel dove off Palm Beach on July 14, in 600 feet of water, and allowed the Gulf Stream current to carry it northward along the continental shelf to a point off New England. A variable ballast tank kept the sub at depths ranging from 600 to 2,000 feet, while Piccard and his crew of five monitored the viewing ports. It will be years before all their data is evaluated, but they've already reported a number of surprises: few schools of fish were seen; no sign of the "deep scattering layer" of concentrated plankton that shows up on sonar as false bottom was found; on July 19, at 252 meters depth, the vessel was attacked by a swordfish that tried to pierce one of its "eyes"--a forward porthole--but missed.

SOME POTENT PESTICIDES WILL BE REPLACED by less persistent ones in federal and state pest control programs--at least in certain applications, according to the U.S. Department of Agriculture. Dieldrin and heptachlor will give way to chlordane (less toxic and persistent) in the Japanese beetle and the European chafer programs. DDT and dieldrin will also be reduced in the white-fringed beetle program. Chlordane, according to the experts, is less hazardous to wildlife than the other chemicals. In addition, several biological programs are gaining grounds: deployment of bugs that eat crop-destroying insects; sterilization of adult insects; use of synthetic sex scents to lure bugs to their destruction.

ANOTHER ANCIENT LEAKEY SKULL turned up in fossil-rich Olduvai Gorge, Tanzania. This one, according to a report to the National Geographic Society by Mrs. Mary Leakey, wife of anthropologist Louis S.B. Leakey, is the most complete skull yet found of Homo Habilis, a manlike creature who roamed East Africa 2,000,000 years ago. The new skull was discovered by an African member of the Leakeys' staff, Peter Nzube, and lacks only the lower jaw, fragments of brain case and some upper teeth. It was imbedded in the oldest known deposits of the gorge, which are covered with 1,750,000-year-old volcanic rock. Homo habilis, according to Dr. Leakey, appears to be an ancestor of modern man (some anthropologists don't agree), unlike dead-end branches of the two-legged family, such as Zinjanthropus and Homo erectus.

SPECIAL SECTION

THE MOON & SPACE



Almost everyone involved in any way with space exploration—from the astronauts themselves to the editors and writers who report the exciting developments—has been the target of questions from baffled, doubtful and sometimes angry people. "Give me one good reason why we should spend all that money, what with taxes soaring and money inflating?," they ask. To answer that question, and many more, *Science Digest* presents this special section, with Dr. Isaac Asimov's astute analysis plus some fascinating moon lore you haven't read in the newspapers.—*RFD*

WHY WE MUST EXPLORE THE MOON

A well-known scientist and science writer spells out the reasons—practical as well as esoteric—why we have to continue with our space program, regardless of the costs.

by Isaac Asimov

YOU'VE HEARD the opposition, and so have I. Most scientists and people who are excited by the Apollo program have been badgered to death by doubters: "Just give me a few solid reasons why such expenditures and risks are justified!" . . . or . . . "For all those billions of dollars, we won a few baskets of dirt and stones. What could possibly be in that dirt that's worth making such a fuss about?"

Ah, but there are so many mysteries about the moon—and about the earth, too—to which that dirt may hold the key. To begin at the very beginning, the first and most tantalizing mystery about the moon is its being there at all.

Suppose the moon didn't exist. Without our moon we might still regard the objects in the earth's night sky simply as points of light, since there would have been nothing to stimulate the pretelescopic imagination into dreaming of the existence of other worlds. Points of light would scarcely have had the effect on man that a visible disc did—especially a disc like the moon, with splotches and shadows apparent to the unaided eye.

And even after the invention of the telescope, when some of the points of light were identified as sizable globes, the nearest, Venus, still never came closer than 25 million miles, fully a hundred times the distance of our moon. Imagine trying to reach Mars without first cutting our space teeth on the much closer lunar target.

The moon is a superconvenient stepping stone to space, but, oddly enough, it seems to have no business

being there. Something about it is radically different from all other satellites in the solar system.

The solar system has 32 known satellites, distributed among six of the known planets (Earth, 1; Mars, 2; Jupiter, 12; Saturn, 10; Uranus, 5; and Neptune, 2). Of the 32, 25 are small worlds ranging from a few miles to a few hundred miles across.

That leaves seven that are sizable. Jupiter has four of them: Io, Europa, Ganymede and Callisto. Saturn and Neptune have one each: Titan and Triton, respectively. And, of course, earth has the moon. In terms of sheer size, the moon is next to last among these large satellites. Only Europa is smaller.

It is not size alone that counts, however, but the size of the satellite compared with the planet it circles. For example, Jupiter's largest satellite is Ganymede, with a diameter of approximately 3,200 miles. But Jupiter itself has a diameter of 88,700 miles. The diameter of Ganymede is only about 3.6 percent that of Jupiter's.

Compared with giant Jupiter, Ganymede and all the other Jovian satellites are only scraps. We can imagine a huge cloud of dust and gas swirling about in primordial times and slowly condensing to form Jupiter. Tiny subswirls on the outskirts would form the satellites. Even those swirls that produced quite sizable satellites on the earthly scale would be tiny compared to Jupiter—which is eleven times the diameter of earth.

The same is true for the other planets. Saturn's large satellite, Titan, is only 4 percent the diameter of Saturn itself. Neptune's large satellite, Triton, does a little better: 8.5 percent.

Compare this with the moon. Its diameter of 2,160 miles (considerably less than that of Ganymede, Titan or Triton) is 27.5 percent that of earth's. In other words, earth has a satellite that is more than a quarter as wide as itself. No other planet can make such a claim. The moon is so large compared to earth that, seen from a distance, the two might almost be said to make up a double planet.

There is no satisfactory explanation for this phenomenon. One theory holds that, when the swirling cloud of dust and gas condensed to form the earth, a great proportion of it formed a comparatively large satellite on the outskirts. Since this did not happen in the case of any other planet, however, the explanation fails to convince.

It may be that the moon was created in a different manner and did not take shape through a subswirl of dust and gas. Here is an alternate theory:

As the moon circles the earth it drags the ocean water with it, giving rise to the tides. In the shallow parts of the ocean the friction of the moving water against the sea bottom acts as a brake on the earth's rotation. This means that the length of the day is very slowly increasing. It also means—according to the principles of physics—that the moon is very slowly increasing its distance from the earth.

Hundreds of millions of years ago, earth must therefore have been rotating much more quickly, and the moon must have been much closer to it. A couple of *billion* years ago, the

earth must have been rotating very rapidly, and the moon must have been practically touching it. This leads us to consider the possibility that, when the earth was first formed, it lacked a satellite. As it spun rapidly, a piece of it may have broken away to become the moon, and this might explain the moon's size.

There are serious difficulties with this theory, however.

Think of the spinning earth. As the planet turns, its surface makes small circles near the poles, but progressively larger ones farther from the poles. Far and away the greatest sweep—25,000 miles—is at the equator. It is there that the speed is also greatest: 1,040 miles an hour, compared with 650 miles an hour at the latitude of New York.

If we imagine the earth spinning so rapidly as to begin throwing air, water and chunks of solid land into space it would be from the equatorial regions that this material would come, for these regions would be moving fastest. The thrown off material, as it formed the moon and traveled farther from the earth, would continue to circle the planet in line with the equator. It would still be doing that today.

This would also be true if the moon formed on the outskirts of the whirling cloud of dust and gas that was forming the earth. As that cloud whirled, movement would be fastest in the equatorial regions, and it would be there that the moon material would cluster.

The moon, however, does not revolve in line with the earth's equator. It revolves about the earth (and, along with the earth, about the sun) very nearly in line with the *sun's* equator. In this respect, it acts like a planet, not like a satellite.

It could be that the moon *was* an independent planet originally—one that somehow wandered into the vicinity of the earth and was captured by its gravitational pull.

One interesting theory along these lines involves the asteroid belt. Between the orbits of Mars and Jupiter are many thousands of tiny bodies (asteroids), of which the largest is less than 500 miles across. It is often suggested that these asteroids are the remains of an exploded planet. However, even if all of them were lumped together, they would make up a very small planet, indeed.

Can part of the original planet between Mars and Jupiter be missing? If so, it might have been driven by the explosion closer to the sun. It could, in fact, be the moon.

If it is, we might ask when the capture of the moon by the earth was effected. Some geologists argue that there are signs in the rocks of a large catastrophe, a billion years ago or less, that could easily have been the result of huge tides that swept the continents clean. These in turn might have resulted from the sudden capture of the moon which, in those early days, would have been much closer to earth and thus cause the great tides.

It might be, then, that the moon was captured by earth less than a billion years ago. In that case, through most of its nearly five-billion-year history, earth existed as a lonely world only recently joined by its satellite.

UPI

Astronaut Edwin Aldrin became the second man to walk on the moon. The first man, Neil Armstrong, took this historic picture.

Of course, there are catches to this suggestion, too. When astronomers try to work out the actual mechanics involved in driving the moon from the asteroid belt to ultimate capture by the earth, matters become entirely too complicated for easy credibility.

In short, there is no plausible way to explain the moon's position and size. But it *is* there and it *is* extraordinarily large, and the lunar landing may have supplied us with an answer to the puzzles surrounding it.

There are many other ways in which lunar landings may ultimately be useful. The key word, however, is "ultimately." In most areas there will be an unavoidable wait, perhaps a long one, before profits can be realized.

It is easy, for example, to argue that the moon offers an ideal spot for an astronomic observatory. Without an atmosphere, seeing would be unrivaled; the sun and earth could be studied as never before. But it will undoubtedly require many landings on the moon and tremendously complex preparations to set up such an observatory, and the same can be said for almost any other practical aspect of lunar exploration. The possibilities are great, but *when . . . ?*

To cite another example, the vacuum that covers every part of the lunar surface is more free of gas than all but the most hard-won laboratory vacuums possible here. Materials could be manufactured easily, and with purity, for they would lack the gas film that is almost universal here. The techniques of w e l d i n g would be utterly changed, while metallic films could be layered onto other substances with unparalleled thinness.

During the two-week lunar night it would be much easier to refrigerate objects at temperatures approaching absolute zero (–459.69° F.) than it is on the much warmer earth. Devices like computers and large magnets, which make use of unusual properties that exist only near absolute zero, could more easily be constructed and studied.

The energetic radiation of the sun in the far ultraviolet region and beyond is stopped by earth's atmosphere. But on the moon it reaches the surface. Such radiation could be used to initiate novel chemical reactions. The effect of radiation on the cause or cure of cancer, on mutation, on cell damage, could be studied.

But we don't know when elaborate factories and laboratories can be built to take advantage of all these opportunities.

An independent colony on the moon might be of great use to earthmen psychologically, offering us the stimulating vision of a renewed frontier and the profitable example of a closed society making rational use of its limited resources. But when can such an independent colony be established?

It is only natural to dismiss these long-range possibilities rather impatiently, and to ask whether the early lunar landings can be useful in any way—and this is where those samples of the moon's crust come in. If the moon was once part of the earth or of the dust cloud from which the earth was formed, its crust should be very much like the earth's.

But this might not be the case if it had originally been part of a planet

UPI

Man's first feeble steps on the moon are the beginning of a quest that may answer some of humanity's most profound questions.

in the asteroid belt beyond Mars. The dust cloud out there, two or three times as distant from the sun as we are, might well have been significantly different in chemical composition from our own dust cloud. The planet taking shape under the conditions of temperature and radiation in that part of the solar system could have developed a different crust. Our first moon dirt samples are unearthlike in that they are remarkably rich in titanium. Unless we happened to hit a lunar titanium *mine*, this could be an indication that the moon did not originate in the neighborhood of the earth, but is an acquisition of our planet.

If this is shown to be true, the samples that Armstrong and Aldrin brought back will have given us a bonus we could not have realistically expected. The samples will have allowed us to travel 237,000 miles to explore a portion of the solar system that should have been perhaps 237 million m i l e s away—a thousand times as far as the moon.

If, on the other hand, analysis of the lunar material shows the likelihood that the moon has always existed in the vicinity of the earth, we need not feel disappointment. There could still be much to learn. There are the newly discovered mascons—regions of higher than average density centered about the moon's large, flat areas (the "seas"). The mascons, as we found out on previous Apollo flights, affect the orbits of space vehicles circling the moon. They may well be the buried remnants of the dense meteorites that gouged out the seas, or, less likely, layers of sediment left in ages past when and if the seas actually contained water.

The astronauts also reported softer outlines on the mountains on the side of the moon away from earth than on the side we are used to seeing. It is possible that there was more erosion on that side. In any event, the different characteristics indicate that the two sides have had different histories.

In addition, although the moon's crust, if formed in the earth's vicinity, might have been much like the earth's at first, the subsequent history of the two worlds has been radically different, and that could tell us a great deal, too. Over billions of years, the earth's crust has been enormously affected by the action of wind, water and living things. As a result, virtually nothing remains that can shed light on what conditions were like more than, say, half a billion years ago.

On the moon, however, the action of wind, water and living things has been m i n i m a l. To be sure, the moon's crust has been affected by temperature differences, solar radiation and meteor bombardment, but the resulting effects have been small compared with those on the earth.

It follows that we could learn more about the earth's early history from moon crust than from earth crust itself. Between what astronauts Armstrong and Aldrin saw, photographed and instrumentally detected, and the analysis of what they brought back, it is quite conceivable that we may learn a great deal about conditions on earth two to four billion years ago. And, of course, we could learn an enormous amount about the early history of the moon.

There is also likely to be more in the moon's crust than the minerals and crystals we expected to find. The presence of glass in the lunar dust is

The desolation that the Apollo 11 crew found on the moon may hide many of earth's secrets.

a good example. If the moon had its origin in the neighborhood of the earth, it should have received its share of the common elements and molecules that go into the makeup of earth's atmosphere and ocean. If it was once part of the earth, it might have brought some air and water with it when it broke away.

To be sure, the smaller gravitational pull on the moon's surface (only one-sixth that of earth) would have been ineffective in holding any ocean and atmosphere in the long run. But what is "the long run?" For some millions of years the moon may have retained a shrinking supply of surface water and a gradually thinning atmosphere. Some surprising evidence in favor of this theory comes from recent satellite photographs of its surface. Meandering marks have been found that look so much like dried-up river beds that it is hard to think of anything else they could possibly be. In addition, astronauts' samples confirm the browns and tans. These colors usually imply the existence of iron oxide, and their presence might mean that there was once some free oxygen on the moon.

If the moon had an ocean and atmosphere once, their simple molecules might have undergone changes similar to those on earth, since both bodies were exposed to the energetic radiation of the same sun at about the same distance. These changes are of particular importance because they ended in the development of the enormously complex molecules of living tissue. Biochemists have been trying to duplicate the changes in laboratory, setting up small-scale analogues of what they imagine primordial conditions to have been.

Naturally, it is difficult to determine how accurate these analogues are and, therefore, whether the laboratory results are to be trusted. On the moon, however, we may have a ready-made "experiment"—one in which the changes began and then came to a halt at some midway point, when the ocean and atmosphere finally disappeared.

In our present or later moon-crust samples biologists may find undebatable organic molecules representing a point part of the way toward life. Perhaps the molecules may even have reached a moonborne life far more primitive than anything on earth, but superlatively interesting for that very reason.

And if the moon was once part of earth, these organic traces might have been formed from earth-developed chemicals. We would, in that case, have a view of early biological evolution long since blotted out on earth itself.

In any case, the study of organic molecules in the moon's crust might advance our knowledge of the formation of life by decades, compared with the much slower advance possible in earthbased experiments.

Of course, one bag of rocks can't tell us all. We need samples from various parts of the moon—samples that have been subjected to different environments. Some areas of the lunar surface are subjected to more direct light, more hard radiation and greater extremes in temperature than

UPI

The American flag deployed by the Apollo 11 crew symbolizes the involvement of the U.S. in seeking knowledge of the universe.

are others. The researchers' need for a number of samplings may prompt the construction of a lunar base.

We should not think that the question of the chemical evolution of life is something that interests only ivory-tower biologists. It is quite conceivable that research in this area could be immediately useful to medicine.

With all the biological advances of recent decades, we still remain pitifully ignorant of what goes on inside cells. For instance, we know that we can alleviate the symptoms of diabetes with injections of insulin (see page 76 this issue) and that we can cure scurvy by adding ascorbic acid (vitamin C) to the diet. We do not know, however, exactly what insulin or vitamin C do in the body. In fact, we don't know the fine workings of any hormone.

We do engage in successful hormone therapy by carefully monitoring the effect of these substances on the body. We don't know what the hormone is doing, but, if we produce the right chemical relationship, we may get results. The fact that we don't know what it is doing, however, means that we have no way of predicting undesirable side effects until they display themselves in what is sometimes a most unwelcome fashion.

If investigations of hormone action are unsatisfactory, those into the still more complicated problem of cancer have brought even fewer results. None of the research lavished on it in the 20th century has told anyone exactly what goes wrong in a cancer cell. Something *is* wrong, obviously. The cell is not normal; it keeps growing and reproducing when it shouldn't. But we don't know what chemical activity has t a k e n the wrong turn. Until we find out, we may not have much chance of discovering a cure.

It is so hard to determine exactly

The hostile, desolate lunar terrain may contain answers to the history of not only the moon but also of the earth and evolution of life forms.

UPI

The moon is a stepping stone to space that has intrigued man for centuries. The 1970s should see the advent of lunar colonies.

what is happening inside a cell because so *much* is happening. There are thousands of chemical reactions and physical changes taking place simultaneously, all affecting each other in the most delicate fashion. It is like trying to unravel a fine cord that has been worked into an intricate ball a foot in diameter.

But suppose our analysis of the moon's crust tells us that the chemistry of its organic molecules is at a stage partway to life, or shows us the chemistry of a sublife far more primitive than earth's most primitive cells. We may then have visible clues to the workings of the cell—clues that are obscured in earth cells by towering complications.

Once we discover the basics in this way, we might have some notion as to what goes wrong in a cancer cell. With that knowledge, biologists might be able to turn to earth cells and, knowing exactly what they are looking for, determine the cause of cancer and possibly other diseases.

This, therefore, is the answer (or, anyway, *an* answer) to those who ask why we have spent billions to reach the moon, when it is so much more important to cure cancer on earth. All science is one. If we push back the boundaries of darkness in any direction, the added light illuminates all places and not merely the immediate area uncovered.

It is just conceivable, in other words, that by taking the long trip to the moon we have traveled the shortest route to unmasking the riddle of disease on earth. ■

For further reading

LIVING IN SPACE. *Mitchell R. Sharpe. Doubleday. 1969.*

Man on the Moon Special. SCIENCE JOURNAL *IPC Business Press Ltd. London. May 1969.*

U. S. ON THE MOON. *U. S. News and World Report, Inc. 1969.*

THEY FIND MOONSCAPES ON THE EARTH

Astrogeologists are studying certain areas of the earth in order to find out more about the moon. They have discovered striking similarities.

by Bruce Frisch

THE ROUGHLY 50 pounds of moondust, soil and rocks astronauts Neil Armstrong and Edwin Aldrin snatched out of the Sea of Tranquility last July will yield clues about the moon for months, even years to come. They may even help shed light on how earth and its moon were formed. But just as all the sand on Miami Beach would not explain the Rockies, 50 *tons* of such samples could not solve all the geologic puzzles of the moon. Someone will have to vist the lunar equivalents of the Rockies, or the Rift Valley or Mauna Loa. Picking out such potentially profitable landing sites, as well as scouting safe spots for the first landings, is the job of the Astrogeology Branch of the U. S. Geologic Survey. The branch studies geological features here on earth to learn how worthwhile visiting a similar site on the moon might be.

The direction of the branch's thinking was set in 1957 when Eugene Shoemaker was studying nuclear blast craters for the Atomic Energy Commission. His interest spread to Meteor Crater, Ariz., then to the craters of the moon. When the Astrogeology Branch was formed in 1960, he became its head. Now 250 people staff its offices in Menlo Park, Calif., south of San Francisco; Flagstaff, Ariz., and Washington, D. C. Shoemaker has gone on to become the Chairman of the Division of Geologic Studies at CalTech.

Where possible the branch tries to duplicate meteorite hits by firing projectiles from a super-high-pressure air gun at NASA's Ames Research Lab near Menlo Park, or by ramming a metal plate into basalt rock with a shaped explosive charge. But the method that sets the group apart

is comparing features on earth with similar appearing ones on the moon. At first they relied on the telescope, through which they could see objects no smaller than about six-tenths of a mile in diameter. Then in the mid-60s the Ranger series of hard-landers sent back photos of small areas showing objects as small as a few yards across. These told Harold Masursky, who heads the reconnaissance half of the branch (the other half maps lunar traverses for future missions) that their findings held true for small as well as large features.

Later, the Orbiter lunar satellite sent back photos of the whole moon more detailed than those taken from earth. In earth-based photos, resolution falls off seriously toward the limb of the moon, so we knew little of one-third of the front as well as the invisible back. Other Orbiter photos gave one to two yards resolution of small areas. They confirmed what Ranger had hinted, that mass erosion by slumping and sliding took place on a major scale. This showed most clearly in the Orbiter photo of the crater Copernicus that has been called the "photo of the century." Successive cave-ins around the rim, it revealed, have enlarged the crater diameter by one-third.

When Surveyor landed softly on the moon's surface, it took pictures showing objects as tiny as ½₅th of an inch. Experiments it carried gave strong evidence that basaltic lava flows fill the maria.

But until last Christmas all photographs from the moon had been taken by kin to television cameras and sent back by radio prey to a host

Earthrise from the moon is one of the most remarkable pictures taken in the 20th century.

UPI

Lunar rocks brought back by the Apollo 11 crew are still being carefully studied for signs of life by Houston Space Center scientists.

of electronic distortions. The astronauts aboard Apollo 8 brought back the first film. From these pictures Masursky's people made the best contour maps up to that time in a day and a half. While complex reprocessing of the Orbiter electronic signals by computer had produced earlier maps, "It took thousands of times more work to do a lousy job," says Masursky.

Most Apollo 8 pictures were of the back side. From Apollo 10 Masursky got more of the front. On this shot the two astronauts aboard the Lunar Module carried a camera loaded with color film down to 50,000 feet altitude.

One feature Orbiter photographed in revealing detail was Hyginus Rille, a trough over 100 miles long and two miles wide. Rocky outcrops at the edges of craters along one branch looked similar to volcanic vents on earth. They sent Dr. Desirée Stuart-Alexander, a young woman with a good reputation as an astrogeologist, in the summer of 1967 driving in her Travelall to Mexican Hat, Utah. After passing its 10 people, two gas stations and two motels (left over from a uranium rush a decade ago), she followed a dirt road for 10 miles through the Navaho reservation. Seven more miles through stream beds brought her to Mule Ear. She found particles carried up from as deep as 50 miles beneath the surface, leading Dr. Masursky to rate the Hyginus vents a likely source of knowledge of the inner moon.

Moon scientists fight most about whether volcanoes or meteorites carved the face of the moon. Starting from Dr. Shoemaker's studies of nuclear craters, the branch has done much to identify which craters impact has formed. When a meteorite penetrates into the ground, it vaporizes explosively much like a bomb. High speed movies of the Sedan underground nuclear blast in Nevada showed the ground bulging upward like a bubble over the explosion (see "Underground nuclear explosions," *Science Digest*, June 1969, page 7.) Jets of material broke through the dome and plowed up lines of secondary craters across the desert. On the moon, these secondary craters probably form the rays coming from craters by punching through the darker surface into the lighter material beneath.

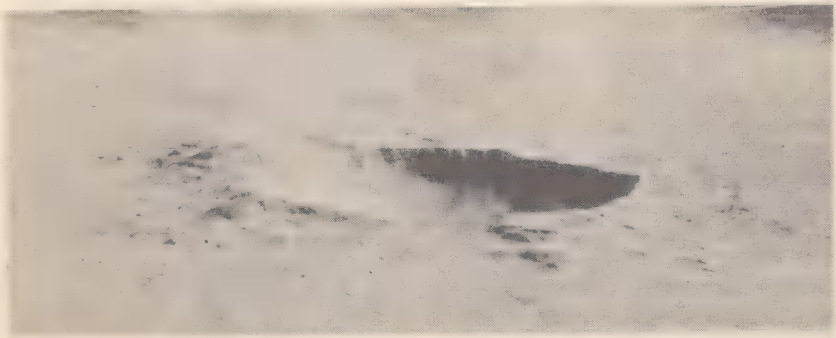
Meanwhile, the flanks of the dome turned over and fell upside down around the edge of the crater. Fine material flung high in the air began falling back and flowing out away from the crater along the ground. As this "base surge" encountered small unevennesses, it built up into dunes. On earth, the remains of base surge quickly blow or wash away. Even on the moon they disappear relatively quickly; it took quite a bit of searching before the astrogeologists found

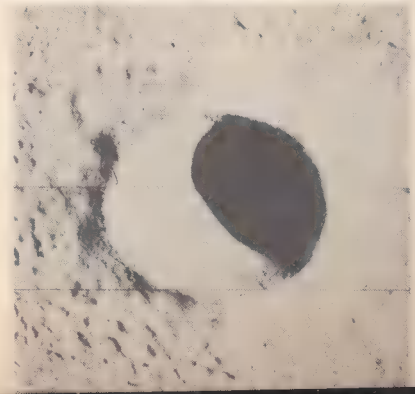
an Orbiter photograph of a young, still warm crater, Mösting C, which still retained the dunes.

Flowlines of the base surge are clearly visible for 800 miles from the center of what Masursky calls "the grandest feature photographed by Lunar Orbiter," Mare Orientale. Barely visible at the northwest edge of the moon from earth, it showed up as an enormous bulls-eye-shaped basin on Orbiter photos. Here, the base surge of the Nevada tests occurred on an immensely larger scale. Some of the surrounding mountains through which the boiling cloud coursed are more than 20,000 feet high. Circling Mare Orientale were concentric rings of fractures.

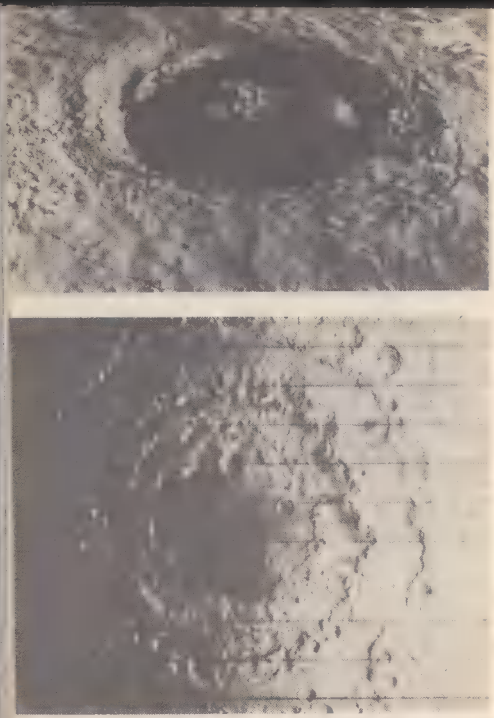
Masursky and his men saw similar fractures formed by a massive explosion in Canada. As part of the Plowshare study of excavation by nuclear bombs, scientists of the Canadian Research Establishment set off 500 tons of TNT. They piled cast chunks of the explosive the size of cinder blocks in a hemisphere on water-logged bedrock at the Suffield Experiment Station in Alberta. Because water so efficiently carries energy into the ground the crater formed was six times the volume of A-bomb craters in dry Nevada. Around the hole cracks opened so round they might have been drawn by compasses.

Countering these many indications of impact on the moon are the peaks at the centers of some craters. At least superficially these suggest volcanism. Shoemaker had taken an interest in a similarly situated hill in Sierra Madera, Texas, when the





These are not both photographs of lunar craters. At right is crater Mösting C, photographed by Orbiter III in 1968. The one above was caused by an underground nuclear explosion of 100 kilotons at Sedan in the Nevada desert test site. Astrogeologists discovered striking similarities between the two craters. After the nuclear blast, dunes were built up by the swirling clouds of the base surge. The dunes were eroded away in just a few weeks. The sight prompted the scientists to look for dunes around young lunar craters. They found them around the base of Mösting C. These dunes, too, eroded quickly.



Similarities between TNT blast in Sheffield, Ont., (top) and Mare Orientale (above). Both are ringed with concentric circular fractures.

Sinuous rilles on the moon (above) resemble the meandering pattern of riverbeds on earth (top), but the moon has no apparent water.

branch was first formed. Later he turned the investigation over to Dr. Howard Wilshire.

A few other geologists had studied it because it differed so much from the mesas on the surrounding plateau. One prominent geologist had called it volcanic, others said it was a result of impact, so Wilshire went to decide for himself.

He found the hill surrounded by a low ring of hills seven miles in diameter, all that remained of the crater rim. Elsinore Ranch sat in the crater, and the Ft. Stockton-to-Marathon highway passed through it. Large herds of antelope and wild pigs ran there. And rattlesnakes slithered among lechugilla plants with foot-long leaves tipped by thorns that could, with little trouble, go right through a soft boot into your leg.

Wilshire was fortunate in having oil drillers' records of what kinds of rock they had gone through on the way down. For years oil company geologists had dismissed the hill in the center of the crater (in fact, they had not recognized that it was in a crater) as an igneous intrusion. But finally a wildcatter who knew nothing about geology drilled blindly. He hit no oil, but he hit no column of solidified lava either, and the big companies followed after. All freely gave their data to Wilshire except the right-wing millionaire H. L. Hunt, whose findings Wilshire had to get through the back door.

With all the evidence in, Wilshire and his co-workers began to draw conclusions. Was the hill, as Shoe-

maker had thought, rock shattered into breccia by an impact? No, but it *was* caused by impact. The surprising sequence of events they pieced together was this: Before the impact, the rock strata lay flat like the layers of pastry in a Napoleon. The exploding meteorite bent down the strata which then rebounded upwards into an arching hill. Rock layers originally buried at a depth equal to one-sixth the crater's diameter were thus brought to the surface.

In a lunar crater the size of Copernicus, this means the structure of the moon from ten miles deep sits on the surface at the central peak for astronauts to study. As a comparison, the eroded walls of Grand Canyon reveal only a one-mile thickness.

It will probably take on-the-spot investigation to solve one of the most intriguing mysteries of the moon: What carved what look like meandering river valleys? These usually begin in a crater six to 18 miles across, then wind a sinuous course downslope. From the crater Cobra's Head, Schroter's Valley twists 100 miles. Without suggesting the moon has a monsoon season Masursky points out the similarity between these valleys and those formed during the Pleistocene Epoch on earth. In that age of torrential rains, immense rivers cut broad channels. Later, when the rains slackened, the shrunken streams cut other narrow, meandering channels within the large ones.

Scientists have offered three possible explanations. Liquid lava may have boiled down the channel. Or the valley may, indeed, have been formed by a stream of water if an impact melted permafrost conjectured to lie below the surface, or a comet brought its cargo of dirty ice.

But the stream need not have been liquid. It could have been a Pelean cloud. In 1902, Mont Pelée rumbled to life on the island of Martinique but could not erupt because debris plugged its crater. Finally Pelée blew out its side, sending a cloud of hot gases carrying fragments of volcanic rocks blasting through the city of St. Pierre at perhaps 300 miles per hour. The cloud killed 30,000 persons and sank a dozen ships in the harbor.

Since the moon valleys look so much like river valleys, hydrologists have studied pictures of them. However, when the astronauts have a lunar roving vehicle to reach them, says Masursky, "Study of the source vents, channel deposits and sediments at the ends of the valleys should help settle this fascinating question." (See "Once we've reached the moon," April 1969, page 42.)

As logical as the ideas of Masursky and the Astrogeology Branch sound, a number of other scientists disagree with them. The combativeness of lunar specialists has led Arthur C. Clarke, who wrote the movie and book "2001," to predict, "As soon as we land the first two geologists on the moon, in 10 minutes they will be throwing rocks at each other in defense of their rival theories." ■

For further reading

EARTH, MOON AND PLANETS. *Fred L. Whipple. Harvard University Press. 1968.*

EXPLORING SPACE WITH A CAMERA. *Edgar M. Cortright. NASA. 1969.*

SPACE. *Patrick Moore. The Natural History Press. 1969.*

MOON MADNESS: DOES IT REALLY EXIST?

The power and mystery of the moon has intrigued man for centuries. Is it possible that it really has some hold over us?

by John Cottrell

WHEN CHARLES HYDE, a laborer of St. Columb Minor in Cornwall, England, was charged with housebreaking in 1953, his lawyer described him to the court as "a Dr. Jekyll and a real live Mr. Hyde." He explained that the man was a good worker, husband and father. "But he suffers from a kind of moon madness. He seems to go off the rails when the moon is full." Mrs. Hyde also testified to her husband's fine qualities. "But he gets this moon trouble, acting very strangely and going off for a week at a time."

One year later Hyde was back in court—charged with breaking probation. Just before a full moon, he had suddenly felt tired of his pick-and-shovel life and had slipped out of the country to join the French Foreign Legion. He had traveled 1,200 miles to Sidi-bel-Abbes, the Legion base in Algeria, only to be given another pick and shovel and told to help build a canteen extension.

Hyde was eventually discharged from the Legion on medical grounds. Back in Cornwall, he was again put on probation. But on May 3, 1954, the night after a new moon, he broke into his brother-in-law's house and stole a checkbook and wallet. This time the court was not moved by his defense of "moon madness." He got an 18-month prison sentence.

For countless centuries man has linked phases of the moon with madness and impulsive action. But in mid-July American astronauts Neil Armstrong and Edwin Aldrin actually walked on its scarred surface and returned to earth. They showed no sign of moon madness—in fact, their reactions were quite the contrary. Does this mean the death-blow to all that superstitious old moonshine about the supposedly baleful

influence exerted by the moon upon the minds of men? Strangely, it is not so. Such are the mysteries which still surround the real physical influences impinged on the earth by the moon that it will be regarded with awe long after its conquest by man.

Even in this Space Age some absurdly illogical moon superstitions survive on earth. In fact, much of the world still doesn't know about the Apollo 11 success. In New Guinea and Africa, women still hold out their babies to the new moon so that they may grow straight and strong. In Greenland, some women continue to believe that they will become pregnant if they sleep in the moonlight. At the next total eclipse of the moon, on Feb. 10, 1971, tribal villagers in remote parts of South America and the Pacific Islands will hold noisy rituals to fend off the evil blackness.

Nor is moon superstition confined to primitive peoples. In city streets, coins are still turned irrationally in pockets at the first glimpse of a new moon. In parts of Scotland women still curtsey to the full moon. In England, one can still find old country folk who fear an eclipse of the moon may make their cattle sterile; or who insist that cauliflower must be planted only when the moon is new, and root crops when it is full or waning.

Of course, we can dismiss all such beliefs and practices as superstitious nonsense. And yet, tantalizingly, we still don't know precisely how, or to what degree, the moon affects living organisms. Without this knowledge, it is not so easy to dismiss the possibility that the moon may directly influence the mind of man.

The link between the moon and the human mind was so firmly accepted in ancient times that the word "lunatic" was coined from the Latin for moon. Milton wrote in *Paradise Lost* of "Demoniac frenzy, moping melancholy and moonstruck madness." Francis Bacon propounded the idea that "the brain of man waxeth moister and fuller upon the Full of the Moon." Sir William Blackstone, an eminent 18th-century lawyer, defined a lunatic as "one who hath lucid intervals, sometimes enjoying his senses and sometimes not—and that frequently depends on the changes of the Moon."

In 1963, at an international meeting in forensic immunology, medicine, pathology and toxicology at London University, Dr. E. A. Jannino of Lynn, Mass., presented a paper in which he put forward the possibility that both Jack the Ripper, the London maniac killer of five women in 1888, and the then unidentified Boston Strangler were both victims of "moon madness."

High voltage readings

After pointing out that literature and folklore were rich with moon mood references, Dr. Jannino stated that modern scientific investigation indicated a change in man's electrical potential twice a month coincident with the full and new moons. "A maladjusted group studied had the highest voltage readings."

It was, in fact, the notable American psychiatrist Dr. Leonard Ravitz who carried out this investigation by measuring "electrical waves" given off by the human body. A fairly typical case-record from his early reports reads: "A 34-year-old patient suffering from schizophrenia gave readings reaching their highest level on the

Illustrations The Bettmann Archive

The history of man is filled with stories of strange behavior during periods of the full moon or during lunar eclipse. The moon was believed to control the growth of crops in the fields, the sex of unborn children and the fertility of cattle and domestic animals. This old cut shows the terrified members of primitive Peruvian tribes warding off the evil from an eclipse.

day of the new moon. This was always associated with feelings of 'pressure on his mind.' He was considerably more tense, irritable and preoccupied at such times."

But more recently, after further work, Dr. Ravitz has said that he is convinced that the phases of the moon have *no direct effect* on human behavior. This concurs with the majority view among scientists: that the occurrence of mental lapses at the same time as a new or full moon is purely coincidental.

It is argued by non-believers that acceptance of "moon madness" probably came about because some forms of insanity are periodic, with maniacal excitement seeming to wax and wane in a similar way to the moon. Some periods of mental aberration must coincide with the full moon, but if these coincidences were a general rule, then mental hospitals could become unmanageable at full moon time.

Six years ago Alan Dennis Witcomb, a baker's assistant of Birmingham, England, was found guilty but insane on a murder charge after his sister had testified that he had often told her, "The moon does strange things to me." But it is an established fact that, if a man is emotionally unstable and believes he ought to be worse when the moon is full, then he may well be worse.

A few years ago, Chapman Pincher, science correspondent of the London *Daily Express*, carried out his own inquiry into "moon madness." More than 500 readers supplied first-hand information about how the moon seemed to affect their behavior or that of their relatives.

Pincher concluded: "The analysis showed that many people are subject to rhythmic swings of mood which in extreme cases push their behavior beyond the limit of what society will accept as normal. In some cases this cycle happens to coincide with one of the moon's phases so that people occasionally become violent when the moon is full. An equal number of people became violent at new

moon or at the first or third quarter. This suggests that any relationship between madness and the moon is coincidental."

Similarly, New York psychiatrists, Dr. Stephen Bauer and Dr. Edward Hornick, put the superstition to statistical analysis last year. They reasoned that if a full moon did induce madness it should produce a rise in the number of people seeking emergency psychiatric help at such time. But their analysis revealed no such variation in the number of patients needing help.

Another investigation was conducted a few years ago by American psychiatrist Dr. Curt Richter who made a thorough survey of swings from excitement to depression and back again among patients of the Johns Hopkins Hospital in Baltimore. He found that many patients did indeed show a regularly recurring cycle of mental activity, ranging from normal to abnormal behavior over a definite number of days. But he found no evidence of a consistent link between the mood changes and the moon's phases.

In some patients the cycle recurred about every 28 days—the lunar month. In just as many others it occurred over a shorter period, as little as two days, or a longer time, up to 40 days.

So the study was inconclusive. But from observations on animals Dr. Richter did become convinced that the mood cycles are somehow connected with the "hormone" glands of the body, especially the thyroid gland in the neck and the pituitary gland on the underside of the brain. The latter is known to be sensitive to light through some link with the eyes; thus the egg-laying of hens is increased if they are provided with artificial light all night, and wild birds are prompted to lay by the longer daylight of spring.

However, it does not necessarily

In 17th century France it was almost the norm to be affected in some way by the power of the moon. The townswomen of Baroque France felt compelled to dance in the public square for protection from the lunar force. Their behavior was looked upon as an emotional affliction caused by the moon. The men in the left part of the engraving appear to be looking for some unknown person or some hidden thing.

follow that the extra silver light of a full moon affects human behavior simply by acting on the eyes and the pituitary gland. Mental patients, whose excitability does coincide with the full moon, have been found to be just as extra-active when the moon is obscured by cloud.

From all this, it might seem that investigations have thoroughly demolished the ancient belief that "the moon is the mother of madness." But while there is no firm scientific basis for linking the moon with insanity, the fact remains that earth's natural satellite does exert quite incredible influence on living organisms and may well indirectly affect human behavior patterns to a small degree.

Moon affects oysters

The astonishing power of the moon was demonstrated by Dr. Frank Brown of Northwestern University in Evanston, Ill., when he investigated the oyster's habit of opening and closing its shell with the rising and falling of the tides. In 1953, he took oysters from Long Island Sound near New Haven, Conn., and placed them in a salt water tank in his laboratory 1,000 miles away. The water level and the temperature were held constant, and the room was lit by a dim but steady light.

For two weeks the oysters continued to operate their shells—as though by habit—according to the time of the New Haven tides. They opened their shells and began to feed at the exact moment the moon was passing over the meridian on which they used to be, and when it passed the corresponding meridian on the other side of the earth.

But then the pattern changed. The shells did not open until four hours later than scheduled. Strangely they had adjusted to their new geographical location. Now they were opening whenever the moon was positioned at zenith over Evanston.

The experiment demonstrated beyond all doubt that it was the moon's position which influenced the oysters, not any tidal force.

Many other curious phenomena have been noted. For example, it is the waning period of the moon which starts adult eels on their migration from European rivers, back to the spawning grounds in the Sargasso Sea—3,000 miles away—where they first came to life.

Then there are certain tropical worms, called Palolos, which live in coral rock and emerge only twice a year. Remarkably, they always emerge on the first day in each of the months of October and November when the moon enters the last quarter. This timing is so precise that the natives of Fiji and Samoa include the worms' appearance in their calendar.

Better known is the moon's influence on fish. The biggest catches of herring, in particular, are usually made at full moon; and there is some evidence to suggest that the moon has a direct effect upon the brains of some fish, making them sensitive to tides.

For example, herring trapped in a rock pool have been seen to jump out onto wet sand and flip their way into the ebbing tide—even though their view of the sea was screened. The suggestion is that, as in the case of oysters, the moon—whether visible or not—somehow provides some kind of timing signal.

Clearly, it is not the light itself

that gives the signal. The movement of eels, oysters, herring and worms occurs with equal precision if the moon is obscured by cloud, and, in the case of Dr. Brown's oysters, reaction to the moon's position was even registered indoors.

But how does the moon, whether screened or not, influence living organisms at least 221,463 miles away? And if it can exert some direct pull on living tissues as well as the seas, why should it not have some influence on humans?

The state of electrification of the upper atmosphere seems to vary with the moon's phases. Might this conceivably affect human mental processes? Could the human brain have small granules in the nerve cells which are moved about as the moon changes its position in space? Or might fluids in the cavities of the brain and spine be influenced?

So many questions remain to be answered in this field, providing enormous scope for research projects. One thing is certain, however: the moon can have some indirect influence on our lives by way of its contribution to atmospheric conditions.

Atmospheric conditions are a very real influence on human moods, fits of sudden excitement or depression, lethargy or energy. Experiments, such as those carried out at the Institute for Medical Climatology in Philadelphia, have demonstrated how ions—electrically charged particles which fill the atmosphere—influence our lives. Negative ions—at least in certain concentrations—spice the air with a pleasant freshness and stimulate us. Positive ions have a weakening effect.

In turn, such earthly forces as electricity in the air, barometric pressure and the gravitational field are influenced by forces from outer space—including the phases of the moon.

Influence on man

In this sense, the moon can indirectly influence human behavior, at least to a small degree. And while the moon may not have direct power over the mind of man, it may well play a key role in establishing the rhythms of nature to which all of us are tuned.

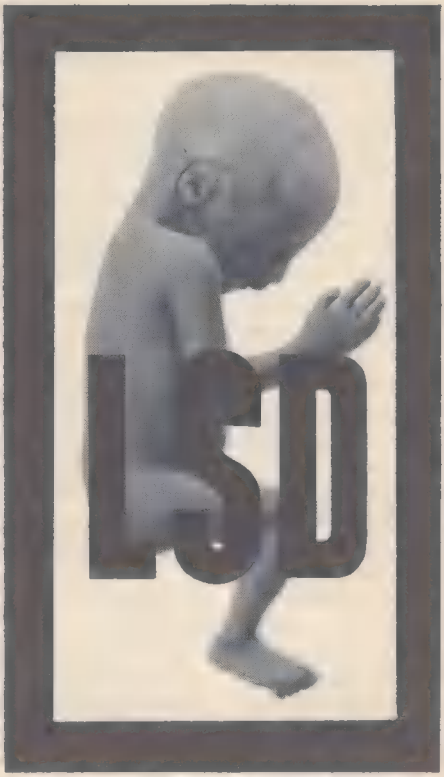
Is it, for example, just coincidence that, in time duration, a woman's 28-day menstrual cycle is the same as the lunar orbit? Could it be that the 28-day orbit of the moon sets up a cycle of electromagnetic force which, by way of a four-week rise and fall of electric currents in the brain, determines both the menstrual cycle and our cycle of mood? ■

For further reading

BREWER'S DICTIONARY OF PHRASE AND FABLE. *Harper and Row.*

HOW DID IT BEGIN? *R. Brasch. David McKay Co. 1966.*

So Long to the Good Old Moon. Paul O'Neil. LIFE. *July 4, 1969.*



American Museum of Natural History

Do mind-bending drugs cause serious birth defects?

by B. Kent Houston, Ph. D.

ARE HALLUCINOGENIC DRUGS—LSD, mescaline, psilocybin, peyote—dangerous? Lurid stories and reports claim that these drugs damage chromosomes and embryos, leading to the birth of "LSD Monsters"—deformed children. The specter of a tragedy like that of thalidomide has created widespread alarm among law makers, physicians and the public.

Let's set aside the claims and the stories and look at the laboratory research on the effects of hallucinogens

on chromosomes and embryos.

Research on the possibility that hallucinogenic drugs damage chromosomes follows three different avenues. The first is to examine the effects of LSD on the chromosomes of white blood cells cultured in test tubes. In a New York study, the chromosomes of white blood cells cultured for varying periods of time with varying concentrations of LSD were compared with the chromosomes of cells not cultured with LSD. The conclusion: LSD had a generally damaging effect.

The procedure used in this study and the data drawn from it are misleading, however. A Swiss investigator demonstrated that most of an LSD dose is excreted from the body within an hour, but the minimum time period used in the New York study was four hours. A California researcher calculated that the maximum effective concentration in the human body after a 100 microgram dose of LSD would be essentially the same concentration as the *lowest* concentration used in the New York study. For this concentration and an exposure time of four hours, the New York study revealed no difference in chromosomal damage between cells cultured in LSD and cells not cultured in LSD.

The second approach to chromosomal damage is to examine chromosomes in the white blood cells of known LSD users. This research has also yielded confusing results. Some investigators in Oregon reported an abnormal amount of chromosomal damage in the white blood cells of LSD users. But a California group failed to find evidence of extraordinary chromosomal damage in eight "hippy" drug users. In New York, two investigators compared the incidence of chromosomal damage in five psychotic children who had received LSD 25 for psychotherapeutic reasons with five who had not received LSD. The investigators found no differences in chromosomal damage between the two groups, even though some of the youngsters had received LSD daily for as long as three years!

A California team compared the frequency of chromosomal aberrations in the lymphocytes of four persons who had received LSD as part of medical treatment, four persons who had taken LSD privately and four control subjects. Again, no significant differences were found between the control group and the two groups of LSD users.

The findings of the Oregon group who reported chromosomal damage in LSD users may have been due to chance. In other words, they may have studied people with existing chromosomal damage who had also taken LSD, or the subjects may have taken drugs with impurities. In either case, no good evidence exists that pure LSD causes chromosomal damage in white blood cells.

The implications of the possibility that hallucinogens cause chromosomal damage are that it would lead to abnormality in offspring. Until recently, however, no one had investigated the effects of a hallucinogen on the chromosomes of the sex cells, the cells that actually affect offspring, or the effects of the drugs on the offspring. Now a Danish group reports that they compared sex cell chromo-

---

B. Kent Houston is an assistant professor of clinical psychology at the University of Texas at Austin.

somes of a group of male mice injected with LSD with a group of mice not injected with the drug. They found very small differences between the two groups in proportions of damaged chromosomes. The results were so modest that the investigators did not even make a statistical test of them.

Two studies recently appeared in *Science* in which the potential of LSD for producing mutations was investigated in fruit flies (*Drosophila melanogaster*). If you've ever taken a course in biology, you may recall that these organisms are used in studying genetics. In one study by a group in Los Angeles, male fruit flies were injected with varying dosages of LSD, and the frequency of mutations in their offspring compared with that for fruit flies injected with a control solution. The highest concentration of LSD studied would be equivalent to a dose 1,000 to 2,000 times greater than normal in humans, but even at this high dosage, no evidence was found that LSD caused mutant offspring.

A scientist at Rice University in Houston injected tremendous doses of LSD into the sex organs of male fruit flies. The results of this study *do* indicate that LSD in enormous doses injected into the sex organ creates an unusual number of mutations. It's important to note, however, that the concentration of LSD that was used in the Rice study was so powerful that it killed 80 percent of the flies and left a third of the survivors sterile. For humans, the same amount of LSD would be equal to 500,000 to 1,000,000 times the normal dosage.

Judging from these results, there simply is no adequate evidence that hallucinogenic drugs in ordinary doses cause chromosomal damage in the living organism or adversely affect offspring as a result of chromosomal changes.

But what of LSD's effects on the embryo? A number of investigators recently have studied the effects of hallucinogens on developing embryos. In New York, a research team compared the effects of LSD injected in rats either early or late in pregnancy with the effects of a saline solution injected in rats. No apparent effects appeared in offspring when LSD was administered late in pregnancy, but substantially more stunted and stillborn offspring resulted when LSD was given early in pregnancy. Two scientists at the University of Wisconsin performed a similar experiment with mice, but instead of waiting until the birth of the offspring, they examined the embryos four days after administering a drug to the mothers. They found substantially more abnormal fetuses in animals injected with LSD early in pregnancy than in animals injected with a control substance during the same period. No gross, observable effects appeared when injections were given late in pregnancy.

A researcher at the Medical College of Georgia compared the effects of different dosages of LSD and mescaline on hamster fetuses with that of the effects of a saline solution on fetuses. The substances were injected early in pregnancy at a time when the developing embryos are most susceptible to the possible damaging effects of external agents. When the fetuses were examined, the scientist found that substantially more had been adversely affected by the hallucinogens than by the saline

a wonderful way to say

MERRY CHRISTMAS

GIVE SCIENCE DIGEST

250 WEST 55th STREET • NEW YORK, N. Y. 10019

1 one-year gift subscription $5.00
2 one-year gift subscriptions $9.00
Each additional one-year subscription . $4.50

Enter the following one-year gift subscriptions, and mail your attractive gift announcement card:

I enclose $_____ ☐ ***Bill me $_____** ☐

**After January 1, 1970*

NAME _____ *(Please Print)*

ADDRESS _____

CITY _____

STATE _____ ZIP CODE _____

NAME _____ *(Please Print)*

ADDRESS _____

CITY _____

STATE _____ ZIP CODE _____

SENT BY: _____ *(Please Print)*

ADDRESS _____

CITY _____ STATE _____ ZIP CODE _____

GIFT CARDS TO BE *Signed* _____

Also include my own subscription ☐

Canadian, Pan-American and Foreign subscription prices on request. Gift card will arrive in Christmas mails.

XD | 9J1

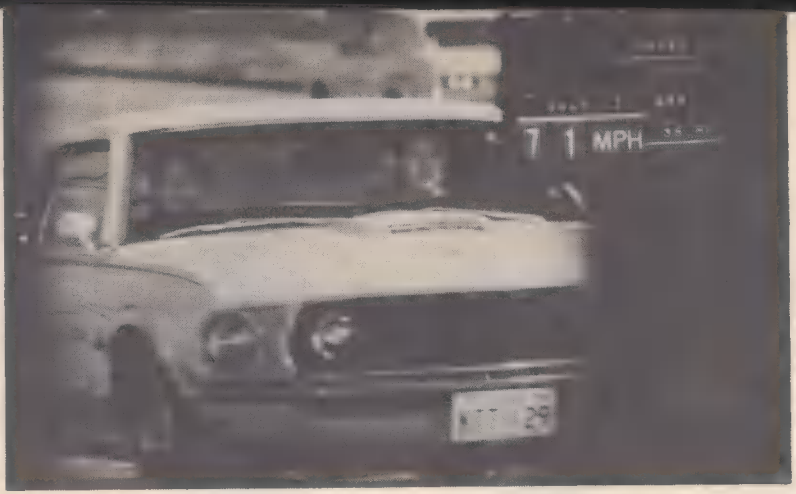
Evidence indicates that fetal development (shown here at three, four and five months) can be greatly altered if a woman takes LSD in early pregnancy. The most crucial period is between the 16th and 22nd day of fetal development—when a woman often is not aware she is pregnant.

solution. The size of the drug dose was not related to the percentage of congenital abnormalities, but it was related to the frequency of resorbtions, dead fetuses and runts.

The only dissenting note in this area comes from a study at the University of Cincinnati College of Medicine. Investigators there did not find effects of LSD in either small or large dosages on developing rat fetuses. Their failure may have been due to their studying a different strain of rat than the one used by the New York group. A possibility exists that the effects of these drugs on embryos may not be the same for different species of animals, or for human fetuses.

In spite of this last study, there is enough evidence that hallucinogens have adverse effects on developing fetuses to cause grave concern. If the period of embryonic development in experimental animals during which these drugs appear to have their most adverse effect is extrapolated to humans, the crucial period for fetuses is estimated to be between the 16th and 22nd day of pregnancy—the period of fetal development during which pregnancy is frequently unsuspected. Girls or women engaging in sexual activity and not taking steps to avoid pregnancy probably should not take hallucinogenic drugs for *any* reason.

It appears that if "LSD Monsters" are going to occur, they will occur as a result of pregnant women taking a hallucinogen at a crucial period in embryonic development, not as a result of mutant chromosomes in the parents. ■



TRAFFIC SENTINEL spots highway speeders and takes a picture of the car, driver, license plate. Included on the same photograph is information like the location, time and date, the posted speed limit and the speed the driver was traveling. The system, developed by LTV Aerospace Corporation, Dallas, Texas, as a highway safety device, completely ignores those vehicles traveling within legal limits.

CHILD-POISONING MEDICINES and other drugs can be kept from youngsters' reach with a special plastic "push-and-turn" cap that can't be opened by small children. The caps have lugs on them which fit into notches on the medicine vial. To open them an adult must press hard on the cap and twist. Developed by Basic Products Company of Oakland, Calif., the special caps are being tested in a number of Western states and in Canada.

CONTROL TV X-RADIATION with a high voltage diode (left) manufactured by Victoreen Instrument, Inc., Cleveland, Ohio. The diode also provides voltage regulation in transistorized TV circuits. Recent scares by independent and governmental agencies regarding the dangers of radiation from color television sets have prompted the development of the device. One major TV manufacturer plans to incorporate the diode into the 1970 models, and it is adaptable to certain older TV models.

BIPS

PUMP WATER WITH A BICYCLE for your camp site, to water your lawn or to irrigate an arid field. "Portapump" (left) was designed by John Frassinato, Toluca Lake, Burbank, Calif., primarily as a useful tool for underdeveloped countries where water is a problem. It can pump water up to 20 gallons per minute and shoot a spray in a 200-foot arc. The device is self-priming, made of light-weight aluminum and is not difficult to operate.

LIGHT-WEIGHT DINGHY (below) is made of expanded polystyrene and appears to be almost as light as a feather (it takes only a half-dozen rugged rugby players to throw it around—if that means anything). The dink can carry eight people in its nine-foot, four-inch space and is claimed to be unsinkable by its manufacturer Polycell-Prout, London. The firm even sawed one in half and tossed the parts into the Thames—neither sank.

Pictorial Parade

SETTING BROKEN BONES is a little easier because of ■ special cast material developed by Solar Laboratories, Inc. The woman at left is wearing ■ cast made of Beta fiber glass, the same material used in Apollo 11 astronaut spacesuits that landed on the moon in mid-July. Cast shown here is hardened by being placed in ■ special cylindrical light source.

The strange world of night creatures

Every morning the lights go out, the animals wake up and visitors to New York's Bronx Zoo see unknown night creatures in a specially lighted building.

by Barbara Ford

THE PACA, a medium-sized rodent with watermelon-like stripes and spots, peers out of the brush with big, bright eyes. In a tree, a four-month-old baby sloth is cleaning his foot as he clings to his mother. Another rodent, a big whiskered nutria, plunges into a foliage-bordered pool. A nectar-feeding bat hovers over a flower. A Greater Antibeus fruit bat darts out of a cave, evades hanging branches and swoops down to the pool for a drink.

"Those bats are flying like nothing's in their way because they've got that radar," observes a boy about 12.

The youngster is looking at a nighttime scene in a South American forest made out of plastic foliage and probably seeing more activity than he would in a real forest. In a new

building at New York City's Bronx Zoo, nocturnal animals obligingly do their thing during the day when visitors to the zoo can observe them. Most of the animals are mammals, since most mammals are nocturnal, but birds, reptiles and a few fish are also displayed in realistic surroundings.

The secret of the World of Darkness, as the zoo calls the windowless building, is lighting. Every morning, shortly before 11, the lights dim in the display areas behind glass walls. To the nocturnal creatures inside, it's night and they're ready for action. When the lights become brighter 12 hours later, at 11 p.m., they retire for the day. Red light, which nocturnal creatures see poorly, if at all, illuminates the visitors' area so that the animals can barely see them.

A light "baffle" at the entrance to the exhibit helps adjust visitors' eyes to the darkness and prevents outside light from penetrating the enclosure.

The arrangement obviously pleases the inhabitants of the World of Darkness. "These are all animals that in ordinary exhibits would be curled up in a corner asleep," says Brad House, curator of mammals at the zoo, waving a hand at scampering squirrels, bounding duikers and playing foxes. "Many of them are responding as they never have before. They've become different animals. One of our keepers came up to me and said, 'You know, the bats are *happy*.'"

House is a bat-lover—he and Fred Jaun, head keeper at the World of Darkness, collected many of the bats for the exhibit—and happy bats occupy a number of cases. In one scene, a representative of the largest

BIPS

World of Darkness leopard (above) crouches almost hidden by his surroundings in his Bronx Zoo home. He and the other animals shown here are only a few of many nocturnal animals which inhabit this special building. The unique lighting system in the World of Darkness has fooled the animals into thinking day is night, so they go about their normal night routine for zoo visitors.

Flying squirrel

bat in the world, the Indian Fruit Bat (Flying Fox) hangs upside down, its five-foot wings neatly folded. Occasionally it turns its head around, seemingly to peer at a visitor. "Ohhhh," shrieks a child. Smaller bats are winging their way around other cases at such great speeds that the less knowledgeable visitors have trouble telling what they are.

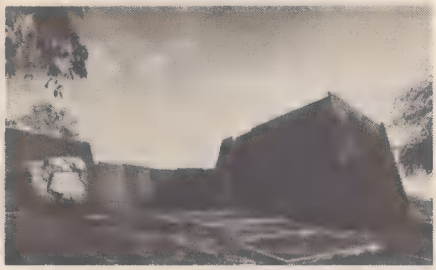
"Is that a bat?," asks a child in front of the South American forest scene that displays six different kinds of bats.

"No, it's a bird," responds her mother after a quick look.

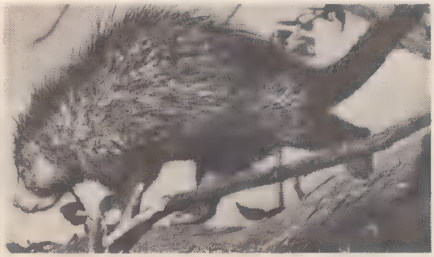
The Fisherman bats put on a show at intervals in a long, narrow case with a pond on the floor. Swooping down at high speed from a case on the wall, they scoop up fish with their long claws. Their ultra-high frequency calls are projected within man's hearing range by electronic equipment. Eventually, House hopes to have trained false-vampire bats flying down to take food from a trainer's hand in the same case.

Different specjes of animals occupy cases together in many of the displays. In a southwestern desert scene, kit foxes, skunks and an armadillo share the same quarters. An African forest scene has two kinds of inhabitants, a pair of frisky duikers (members of the Bovine family) and a porcupine. In an American swamp scene, alligators loaf in a pool while raccoons prowl the bank behind them. In this case, however, an almost invisible glass wall separates the two groups—the only such barrier in the building.

"These animals get along very well



World of Darkness Building



Porcupine

"Goatsucker"

with each other because we had them together before we put them in here," explains House. "In the desert scene, we raised the foxes and skunks and armadillos together and now the foxes and skunks don't know who's who—they sleep in a pile. In the South American forest exhibit, we had the sloths and rodents together for almost a year before we opened the display here."

There were casualties in the South American group, House adds, but it was among the foliage, not the animals. The Capybara, a hairy rodent that looks like an enormous guinea pig, and the Brocket, a tiny deer, both nibbled on the plastic plants with delight. "They preferred it to their own rations," says House. The two species had to be banished to the Small Mammal House nearby.

Not all the animals have adjusted to the World of Darkness, House admits. In a few displays, animals are still sleeping much as they do in an environment with the usual day-night cycle. The shaggy-haired aardvaark spends most of the day drowsing in its red-lighted burrow. The badgers seldom come out of their hole below the roots of a simulated tree stump. The sloth is usually hanging upside down from a tree branch, sleeping.

House terms these creatures "resistant" but he thinks some of them may yet respond to the new schedule. "Any animal in new surroundings takes a while to settle down and now they're trying to convert to a new day, too," he says. He plans, however, to change the dim white or blue light now used in the various scenes to red light in some cases to

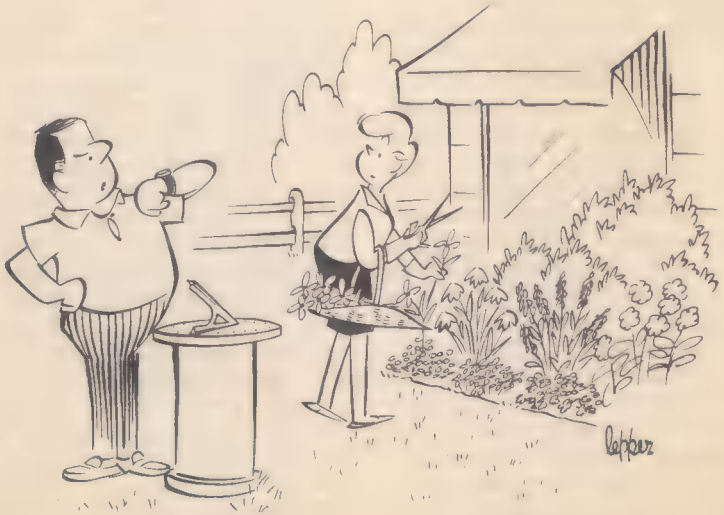
see if resistant animals respond better. Later, if the animals do adapt, he may replace the red light with a dim blue or white one again. The latter are preferable because red light changes the colors of objects.

Other changes may be made in the displays, too, House notes, since many of the techniques used in the World of Darkness are new, or even experimental.

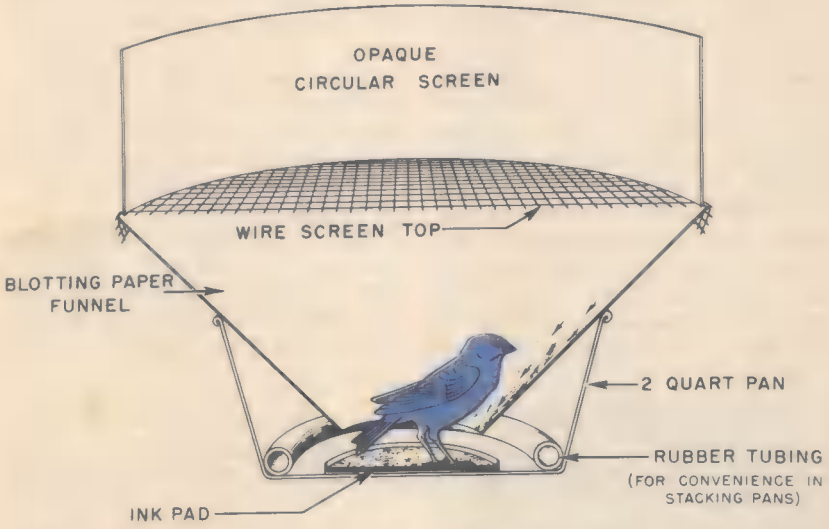
In spite of the problems it presents, House is convinced that the World of Darkness type of exhibit is best for animals and public alike. "There are two main reactions to this exhibit on the part of visitors," he says. " 'I don't see any animals' or 'Isn't it great?' People who really look at animals like to see, say, a wolf in the trees. But there are always the people who complain that they can't see the wolf. They want it behind bars in a cage. I don't think we can let people like that dictate."

Like most older zoos, the Bronx Zoo still has its share of animals in steel cages, but in its new exhibits, it's trying to exhibit wild creatures in what Zoo Director William G. Conway calls "environmental enclosures." Hopefully, seeing animals presented in this way will stir an awareness of the wonder of wild creatures in people previously disinterested in wildlife. Large portions of the urban population, Conway points out, "seldom if ever see wild animals in their natural environments." Awakening an interest in wildlife, Conway thinks, is the first step in conservation.

The animals in The World of Darkness don't know anything about conservation, but they do know they're happy. ■



"According to my watch, this is four minutes fast!"



Paper cage holds blue Indigo Bunting which is being tested to determine its migratory instincts.

Birds migrate by the stars

THE bright blue Indigo Bunting in the funnel-shaped paper cage stands on an inked pad, bill tilted upwards and wings spread and quivering. At intervals, it hops forward onto the sloping wall, leaving inky marks where its claws strike the paper.

The bunting, an eastern U.S. songbird, is under observation by Dr. Stephen E. Emlen, a biologist, who wants to determine how it finds its way on its long migratory flights to the Bahamas, Mexico and Central America. When his captive buntings become restless in the spring and fall, he puts them in funnel-shaped cages made out of blotting paper. Inside, the birds can see only the sky. The marks they make as they hop from the inked pad to the walls of the paper cage tell Dr. Emlen if they can orient themselves correctly.

In the spring, Dr. Emlen reports in *Sky and Telescope*, the buntings hop to the south; in the fall, they hop to the north.

The testing began outdoors under

a clear night sky (most birds migrate at night) but Dr. Emlen soon began exposing the buntings to the simulated sky of the Robert T. Longway Planetarium in Flint, Mich. Results for the real sky and the simulated sky were the same. When he interchanged the south and north halves of the planetarium sky, the bird reversed its direction, but when he turned off all the lights in the sky, it simply hopped around at random.

This behavior indicates to Dr. Emlen that buntings steer by the stars. To find out what star cues they use, he set the planetarium sky several hours ahead of and behind the real sky. The buntings maintained their normal direction, leading him to believe that they get their directional data from star patterns, much as humans do. Preliminary tests suggest that the stars of the northern sky probably provide the essential cues.

The importance of stars in bunting migration doesn't rule out the role of other navigational cues, Dr. Emlen points out. Scientists using radar report large migratory flights on completely overcast nights when stars are impossible to see. Buntings, too, may use different guides than other birds since migratory behavior has undoubtedly evolved many times in the class *Aves*.

Salmon's 2-week fatal fling

When a Pacific salmon enters fresh water for the long swim to his spawning ground, he's a healthy creature with firm, silvery-pink flesh. A few weeks later, after spawning, his pale skin is peeling off, his snout is distorted into a hook and his bones are softening. The tails of many salmon simply fall off. If you examined the liver of one of these specimens, the organ would be a livid olive green from the decomposition products of hemoglobin.

In a few days, the salmon is dead, having run through stages of physical deterioration that normally take a human 20 to 40 years.

What kills the salmon? A Scripps Institution of Oceanography research vessel recently carried 37 scientists interested in aging to British Columbia, where they analyzed spawning salmon. Some of their conclusions: The salmon stops eating when it leaves the ocean and lives on fat it has stored in its body in small orange sacs. The sacs provide the fish's coloration. Meanwhile, the liver begins to fail to remove toxic elements from the blood. The level of lipoprotein (fat and protein) and calcium phosphate in the blood rises to lethal levels.

In spite of the high level of lipoprotein, it does not adhere to the walls of the arteries, as it does in humans and other animals, the scientists found. In fact, the salmon's heart remained in good condition throughout the aging process. What kills it is not a heart attack or stroke but a "complete metabolic shutdown affecting many organs and processes."

Friend-O-Mat

What this world needs is a "Friend-O-Mat," a machine that can respond creatively to human problems, a cultural anthropologist suggests. According to Dr. Henry G. Burger of the Southwestern Cooperative Educational Laboratory in Al-

buquerque, the need for affection is so great today that it can only be met effectively by machines that will dispense "mass tender loving care." The scientific principles and capabilities for such a machine already exist, maintains the anthropologist.

Already, he points out, machines are performing tasks involving affection. In Vienna, a tot with insomnia can dial a number and hear the story of the gingerbread boy. Lonely men in the U.S. can buy a 5'5" pneumatic female companion to cuddle. Billy Graham's staff answers written pleas with an automatic typewriter that responds appropriately to the "40 greatest problems." A machine developed by MIT offers psychotic patients a simple form of therapy.

Dr. Burger has a word for it: "agapurgy," the industrialization and computerization of affection.

Grizzlies must go?

The Great Grizzly Controversy roars on. Should the huge bears—they may reach nine feet in height and weigh almost half a ton—be allowed to roam free in U.S. national parks or should they be resettled in government-owned wilderness inaccessible to the public? In the past four years, five persons have been killed by grizzlies in parks and scores more have been mauled, some so severely they required amputation. All the fatal attacks were apparently unprovoked—several occurred while victims were in sleeping bags.

Biologist Gairdner B. Moment thinks the grizzlies should be transported out of parks like Yellowstone and Glacier, where all the fatalities occurred, and put in their own preserve free of human interference. But a writer on wildlife subjects, Roger Caras, and a part-time park Ranger, Prof. Eldon G. Bowman, disagree. Encounters between bears and humans in national parks should be reduced, says Bowman, but the natural state of the parks should be preserved "unimpaired" — including risks. Caras points out that far more people are killed in automobiles, in swimming accidents and even climbing mountains within park boundaries than are killed by grizzlies.

Thought extinct for 60,000,000 years, this 4-foot, 92-pound Latimeria chalumnae was caught off Africa's coast recently. Dr. Donald McAllister, curator of National Museum of Natural Sciences, Ottawa, measures specimen.

UPI

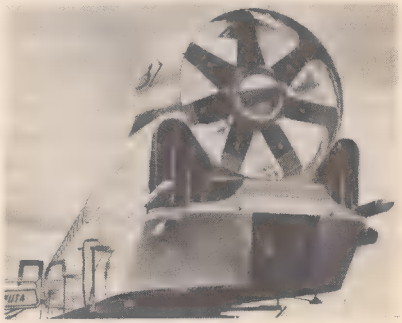
"Should park visitors be restricted in the future to the lowlands?," he asks.

All parties seem to agree on several points: Grizzlies are mean, they have no fear of man and they're attracted to trash and garbage dumps. To avoid bears, visitors to national parks are cautioned to avoid areas where garbage is even occasionally dumped. The two college girls killed at Yellowstone in 1967 by grizzlies were sleeping near an area where the bears often fed on table scraps from an inn.

It's tough to grow males

A vertebrate fetus has a hard time becoming a male, but it's comparatively easy for it to be a female, according to speakers at a British symposium described in *New Scientist*. The sex glands in the vertebrate fetus are structurally equipped to become either male or female and the road they take apparently depends upon the secretion of a still unknown masculinizing substance. If the substance *is* secreted, the tiny sex gland becomes a testes; if it *isn't* secreted, the gland follows its "natural" bent, i.e. becomes an ovary.

At this early point in the fetus' history (the fourth or fifth week in humans), its continued development as a male seems to depend on the secretion of testosterone from its own testes. The female fetus, on the other hand, seems to need no female secretion to develop. If testosterone is secreted but for some reason fails to act on the fetus, it will be born with all the external features of a female. At puberty, "she" will undergo all the normal female bodily changes



Train that floats on air is quite naturally called an aero-train, and it was demonstrated in France recently. The aero-train Orleans rides over a rail on a cushion of air 16 inches above the ground, cruises at 155 mph but can go up to 186 mph, is powered by two 1,200-hp turbo-motors complete with special baffle devices to muffle the sound and has four independent breaking systems. France's high-powered aero-train can carry 80 passengers. M. Leon Kaplan, head of the Societe de l'Aerotrain, says that the aero-train is two to three years ahead of America and Great Britain. Ultimate aim for the aero-train is to use it as a link between Paris and provincial centers.

Pictorial Parade

except growth of body hair and menstruation.

Is the failure of testosterone to act on the fetus in the womb or shortly after birth the cause of homosexuality? The British magazine speculates that in the "acute" homosexual, the reproductive apparatus might have responded normally to the testosterone while the brain escaped—producing an individual with a masculine body and a feminine mind.

Loud voice=coronary

People who talk in a loud voice are more likely to develop coronary heart disease, asserts Dr. Meyer Friedman of Mount Zion Hospital in California. He had 12 patients with angina pectoris, the chest pain that accompanies coronary disease, talk into a special recorder which measures the amplitude of voices. Eleven of them had an abnormally high score on a voice index. The index is calculated as the ratio of total reading time to the time during which the amplitude of the voice is below a certain level. In another test with the recorder, 21 out of 26 patients with a history of heart attacks had an abnormally loud voice index. Both groups of subjects were judged aggressive and ambitious in interviews, qualities which Dr. Friedman related to coronary heart disease in an earlier study.

Living with Wilfredo

Thirty percent more Puerto Ricans enter New York City mental hospitals than non-Puerto Ricans, and most of the Puerto Rican admissions are male. The reason, says anthropologist Edward Preble in *The Bulletin*, a publication of the New York State Branches of the American Psychiatric Association, is the downgrading of the male Puerto Rican's "hombria"—manhood. Both man and wife work in the average Puerto Rican family with children and the traditionally dominant male finds it hard to support his role when his wife contributes as much money as he does. His solution often takes the form of drinking, gambling, fighting, promiscuity and abandonment. Abandoned wives often turn to the New York City Welfare Department for assistance. The wives refer to the Welfare Department as "Wilfredo" (a common male Puerto Rican name). When someone asks an abandoned wife how she is, she sometimes replies, proudly, "I am living with Wilfredo."

Plants that make poison

About 1,000 plants produce poisonous cyanide, including some popular members of the home garden and a few forage crops, reports the American Chemical Society. Among the cyanide producers are laurel, yew, heavenly bamboo, sorgum, New Zealand clover and a type of lima bean used as cattle feed. Cassava, the roots of which furnish tapioca, is also a cyanogenic plant. The highest concentration of cyanide is probably found in the cherry laurel, leaves of which have as high as one percent cyanide. Only fresh plant material is dangerous, the society points out, since boiling or soaking for long periods removes the cyanide. In most cyanide producers, the sweet cyanide occurs together with bitter substances that deter men and animals from eating it. ■

Crash barrier saves lives

IT WAS AFTER A RACE CAR driven by Pierre Le Vegh plunged into a crowd of terrified spectators at Le Mans, France, in 1955, killing 85 people that ex-road-racer John Fitch invented a new kind of highway crash barrier that may save many lives on American highways.

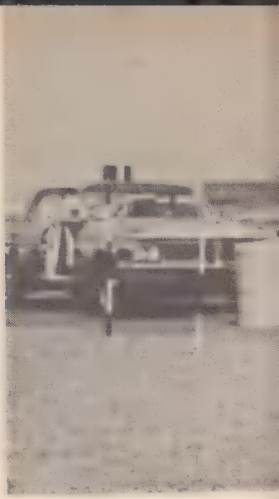
The barrier is a series of large, plastic containers nearly filled with sand. The photographs at right show what happens when a car plows into the barrier at 50 mph. The containers explode dramatically, absorbing much of the energy of the fast-moving car as the sand sprays in all directions. The car decelerates abruptly but with a minimum of damage to the car and injury to the passengers.

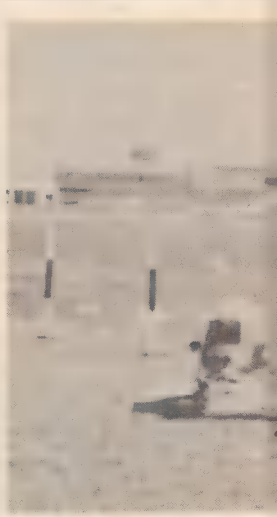
The State of Connecticut plans to install the barriers, called Fitch Inertial Barrier System, at 15 test sites because of the impressive success of the initial test back in April.

What's it like crashing into one of these barriers? Impact with the sand containers has been compared to colliding with an *immovable* object at 10 mph. Its inventor feels the barrier is ideal for such dangerous areas as exit ramp walls, steel girders on bridges, signposts and abutments.

To prove Fitch's point, race car driver Robert Gaudreau spent almost a whole day wrecking cars for an audience of reporters, safety experts and police. He wore a crash helmet and a standard seat belt-shoulder harness combination as he sped down the test strip toward the barrels of sand. When he deliberately slammed into the barrier, he had reached a speed of 50 mph. A monstrous spray of sand engulfed the car as the containers exploded. Gaudreau was subjected to six times the force of gravity as his vehicle strained against the barrels, but his car stopped after only 27 feet. Damage to the car was not extensive and the driver was not hurt in any way.

Gaudreau smiled as he climbed out of the sand-bogged car. He said, ". . . a very cushioned blow—like running into a great big puddle." ■





BIPS Photos

ELECTRONICS

Build your own computing thermometer

An intriguing instrument that measures the temperature of liquids, solids or gases by electronic means can be yours for just $15. You build it yourself out of readily available parts. Here are the complete instructions for it.

by George J. Whalen and Rudolf F. Graf

WHEN YOU NEED some sort of thermometer to measure or help regulate the temperature of a liquid solution (such as photo chemicals), gases, solids, outdoor or indoor atmosphere—nothing else will do. Usually, you can find the kind you need for the kind of job required, but that's all you must use it for. And you'll wind up with a drawer full of specialized thermometers.

The unusual thermometer shown here is a versatile electronic whiz, and if you are at all handy, you can put it together yourself at a materials cost of about $15. It will allow you to determine the temperature of solids, liquids or gases from 30 to 300° F. Its foolproof indicating lights can also tell you when you are approaching a predetermined temperature; that you have reached it; that you are drifting away from it—and in which direction. It will monitor the temperature to within one degree of change. You can also use it for accurate measurement of room temperature, for outside air, or both at once, since the little electronic probe can be located remotely.

Secret of the computing thermometer is its simple thermistor probe, and a simple circuit known as a phase-sensitive switch.

A thermistor is a solid state semi-

Computing thermometer can measure the temperature of nearly anything from solids to gases. Below it is measuring the temperature of a cup of water. The remote thermistor probe is brought in contact with the cup of water.

Bob Berger Photos

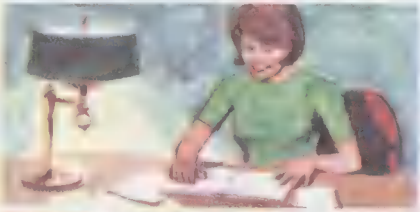
Unique new edition of

word power

3-Volume Roget's Thesaurus and Vocabulary Builder

- *Gives you the right word for every occasion*
- *Shows you how to add as many as 10,000 words to your vocabulary*

Businessmen—Nationwide surveys prove the larger your vocabulary the better your chance for personal success and a larger income.



Students—One of the most important factors in achieving scholastic excellence is a good vocabulary . . . an important "must" for college entrance exams.

Housewives—Being able to express yourself clearly and easily is important to your personal development and your relationship with others.

Civic Leaders—Increase your vocabulary and you will gain confidence, poise, and influence.

A Command of Words is Your Key to Success

Are you afraid to use certain words because you are not sure of their meaning? Do you often come across words that are unfamiliar to you? Are you at a loss for the right word to make your meaning clear?

The English language gives you a wonderfully rich choice of 400,000 words, yet most people skimp by on just a few thousand.

Imagine how much more interesting *your* conversation would be if you could just double your vocabulary! How much more exciting your writing would be if you could be sure of using exactly the right word in the right place. No longer would you have to envy people who speak convincingly and confidently.

Now *you* can add as many as 10,000 new words to your speaking and writing vocabulary. Now you can always have the *right* word at the *right* time.

builder

This exciting new 3-volume combination of *Roget's International Thesaurus* and *The Vocabulary Builder* was designed for people who are too busy to spend long hours in research or tedious lessons. Thoroughly revised to include modern words and phrases, newly arranged for ease of use and completely restyled in handsome matching bindings, these three volumes are the cornerstone of any reference shelf.

The basic principle of a *thesaurus* is the grouping of words by ideas. *The Vocabulary Builder* puts the key to word development within your grasp. Whether you are a student, businessman, housewife, writer, reader or speaker, this exciting set will open new worlds of enjoyment and effectiveness.

Now you can have this complete 3 volume set—ABSOLUTELY FREE—to use for 14 days at our expense. If at the end of 14 days you are not able to speak with greater assurance, write more easily and clearly, and read with greater understanding—simply return the entire set and pay nothing. Use the handy free trial coupon below to order your set direct from the publishers: Career Institute, Inc., a division of Grolier, Inc., publishers of the New Book of Knowledge, Mundelein, Illinois 60060.

SEE DESCRIPTION OF FREE BONUS GIFT OFFER ON BACK PAGE

14 DAY FREE TRIAL OFFER IF YOU RETURN THIS COUPON NOW

EXTRA FREE BONUS GIFT

Instant Spelling Dictionary

972-09

CAREER INSTITUTE, Mundelein, Ill. 60060

Send me for 14 days' free examination the complete 3-volume Roget's International Thesaurus and The Vocabulary Builder plus my free Instant Spelling Dictionary. If not satisfied at the end of 14 days I may return the $19.95 set and owe nothing. Otherwise I'll send a first payment of $5.90 and then 3 monthly payments of $5 each which includes all shipping and handling. The Instant Spelling Dictionary is mine to keep in either case.

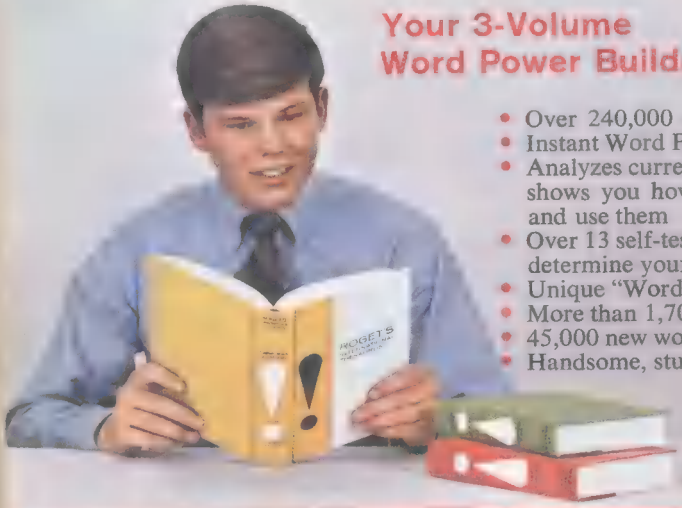
Name_____

Address_____

City_____ State_____ Zip_____

Telephone No._____

SAVE! Enclose check or money order for $19.95 and we pay shipping and handling. Same free trial privilege with full immediate refund guaranteed. (Illinois residents add $1.00 sales tax).



Your 3-Volume Word Power Builder Includes

- Over 240,000 words and phrases
- Instant Word Finder
- Analyzes current dictionaries and shows you how to choose and use them
- Over 13 self-testing quizzes to determine your vocabulary I.Q.
- Unique "Word Analyzer"
- More than 1,700 pages
- 45,000 new words
- Handsome, sturdy slipcase

FREE bonus gift

if you return free trial coupon NOW

Return coupon at once and get this 288-page Instant Spelling Dictionary absolutely FREE. The quick, easy way to find the correct spelling, word division and accent of 25,000 words from A to Z. Also includes the 6 basic spelling rules, Punctuation Made Easy and the Guide to Word Division. Yours to keep FREE even if you return the 3-volume Word Power Builder set.

FIRST CLASS
Permit No. 34
Mundelein,
Illinois

BUSINESS REPLY MAIL
No Postage Necessary if Mailed in the United States

Postage will be paid by—

CAREER INSTITUTE

555 EAST LANGE STREET

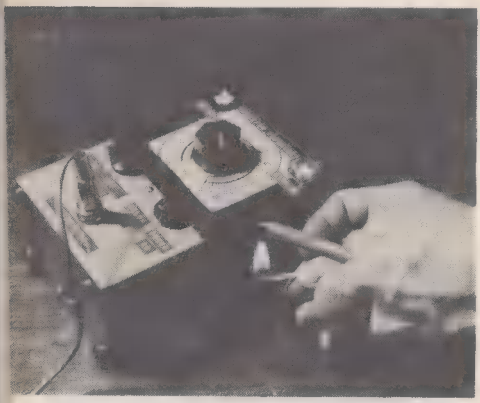
MUNDELEIN, ILLINOIS 60060

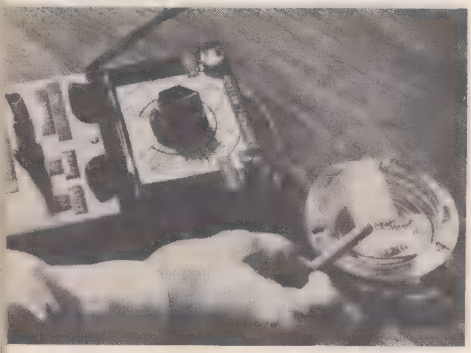
conducting device the electrical resistance of which varies in exact proportion to its absolute temperature. Its temperature coefficient of resistance is high, nonlinear and negative. The phase-sensitive switch provides the computing function in the thermometer. It compares the thermistor's resistance against the setting of a calibrated potentiometer and determines whether or not the potentiometer's setting is exactly equivalent in resistance to that of the thermistor, or if it is higher or lower. The phase-sensitive switch displays its decisions on two panel-mounted lamps —a red lamp designated HIGHER and a green lamp designated LOWER. More on that later. Because of the decision-making qualities of the circuit, there is no need for a meter as a read-out device. Instead, the potentiometer dial is directly calibrated in degrees. To determine the temperature of the medium in which the thermistor probe finds itself, you merely rotate the potentiometer knob and observe the lamps. They tell you whether your setting is on the nose, lower or higher than the exact temperature. When the control is set below the actual temperature of the thermistor, the red lamp turns on. This indicates that you should continue to rotate the control knob to a higher temperature reading. When you reach the setting which corresponds exactly to the thermistor's temperature, the green lamp will come on, and the red lamp will still remain on. When both lamps are on *and at equal brilliance*, read temperature directly from the calibrated dial. If you should pass the exact setting, the green lamp stays on, but the red lamp goes out, indicating that you should go lower in temperature. It is important to note that at the point where the control is *exactly* set to the thermistor's temperature, the red lamp *and* the green lamp will be *equally bright*. A shade off in either direction will dim the red lamp or the green lamp with respect to its opposite. Hence, you can zero in exactly by adjusting the temperature control until the two lamps are equally brilliant.

Balanced condition

The thermistor is connected into an AC-excited bridge circuit, consisting of R3, the thermistor R4, calibrated potentiometer R5 and resistor R6. The AC excitation for the bridge is obtained from a 12.6 volt filament transformer, T1. If the resistance of the potentiometer is identical to the resistance of the thermistor, there is no output when power is applied. This is the balanced condition. In an unbalanced situation, the resistance of the thermistor is either greater or less than that of the potentiometer. The bridge then produces correspondingly greater voltage to the gate of silicon controlled rectifier SCR 1. Diode D5 prevents the gate of the SCR from going too negative. A bias voltage is also applied to the gate from its anode. Both are half-cycle AC voltages, and they can vary in phase with respect to each other; that is, one may be reaching a peak at the instant that the other is just starting to rise to its peak. Thus, the bias voltage can be made to add to or subtract from the bridge input voltage. This is the secret behind the computing thermometer's ability to discriminate so precisely.

T 2 is a 25.2 volt transformer that supplies power to operate the phase-





In the top picture the thermistor is being brought in contact with the flame of a common safety match. Above the temperature of two refrigerator ice cubes is being taken; the left lamp is on to signal that the temperature control should be set lower. Both light on target.

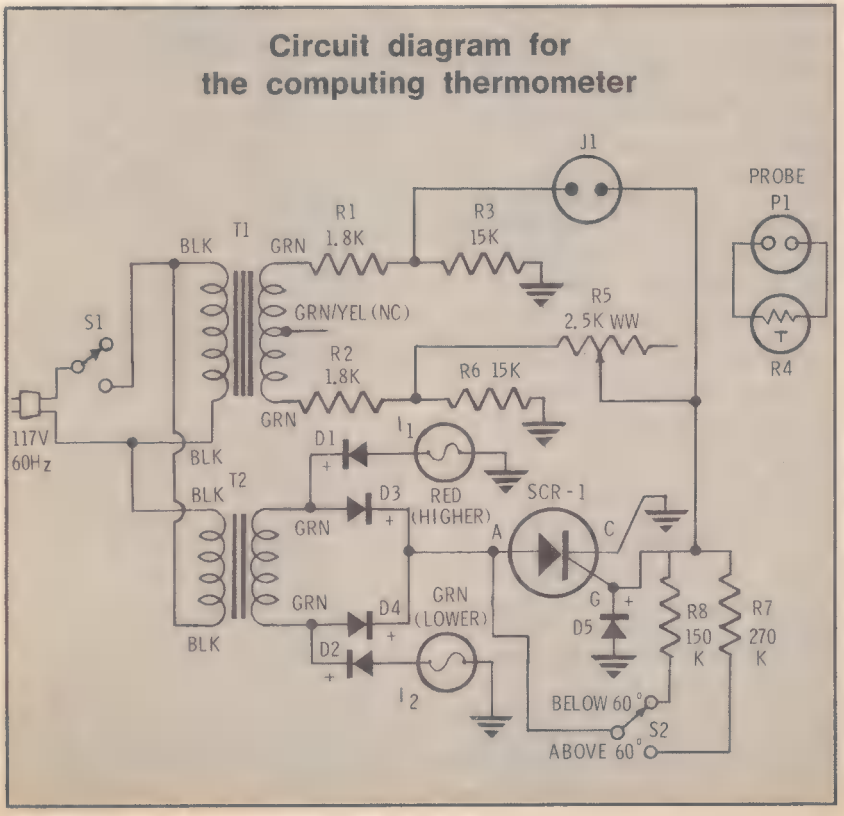
sensitive switch and lamps I1 and I2. The lamps are connected respectively to the end of the secondary of T2 through diodes D1 and D2. These diodes are connected so that only the positive half-cycles of the AC input are applied to either lamp. Diodes D3 and D4 form an artificial center tap on T2 and allow only the positive excursions of the AC input to be applied to the anode of SCR 1. These diodes contribute to the switching action of the circuit. If the bridge circuit is unbalanced because the thermistor's resistance is above or below the setting of the potentiometer, positive pulses from the bridge circuit appear at the gate of the SCR. These pulses will either be in phase or out of phase with the pulses at the anode of the SCR. When the positive gate pulses are in phase with those delivered to the anode through D4, the SCR triggers on each pulse and allows power to flow through it, thereby completing the circuit for I1, the red lamp, through diode D1. Conversely, when the positive pulses from the bridge appear at the gate of SCR 1 in phase with the positive pulses applied to the anode through D3, the SCR triggers, thereby creating a path for current to flow through I2 and diode D2. Feedback from the anode to the gate of the SCR applied through either R7 or R8 permits the SCR to trigger on either high or low temperature pulses coming from the bridge. This arrangement increases the sensitivity of the SCR tremendously. The phase relationship of the gate signal to the power available at the anode of the SCR is determined by the setting of R5 in relation to the resistance to the thermistor R4. Thus by careful adjustment of the control knob, it is possible to pinpoint temperature within one degree of accuracy.

The thermistor probe is assembled using a conventional probe-type shell in which the glass bead thermistor is secured with a good quality epoxy cement. A two-lead cable is attached to the thermistor leads and this terminates in a plug P1 which mates with J1. The thermometer itself is contained in a 7″ x 5″ x 3″ alumi-

num case manufactured by Premier Metals Corp. Transformers T1 and T2 are mounted on the bottom of the case at a 45-degree angle with respect to each other to minimize field coupling between the two transformer windings. The calibrated potentiometer and the lamps are directly mounted to the box, as are switches S1 and S2. The other components of the thermistor bridge circuit and phase sensitive switch are assembled on a piece of perforated phenolic board material, mounted on the top interior of the case. Point-to-point wiring is used to interconnect the components mounted on the board with those mounted on the case.

The simplest method of calibrating the thermometer is to compare it against a known-to-be-accurate laboratory instrument. Fill a jar or beaker with crushed ice and immerse the thermometer. Add an ounce or two of water to this mixture. Immerse the thermistor probe. Do not use it to stir since the probe's tip is small and can easily be broken. Observe the reading of the glass ther-

Circuit diagram for the computing thermometer



mometer and when it reads exactly 32 degrees, rotate the control knob of the Computing Thermometer to the setting at which both the red and the green lamps come on *at equal brilliance*. This point corresponds to 32 degrees. Mark this point on the scale. Heat may then be applied to the mixture. You can use an infrared heat lamp for this purpose. Shining the light on the ice water will result in a gradual temperature rise. As the thermometer reading increases, merely rotate the control of the Computing Thermometer until both the red and the green lamps come on at equal brilliance and mark these points increasingly on the scale. As you reach the higher temperature ranges (above about 80 degrees), it may be advisable to use an immersion-type heater or the low heat range of an electric stove to apply heat to the ice-water. Continue to increase the temperature, while adjusting R5 to the point at which the two lamps come on at equal brilliance. Compare the dial readings against the readings of the glass thermometer, and then mark the reading points on the scale of the Computing Thermometer. In this way, accurate calibration can be achieved up to 300 degrees.

For uniform sensitivity, across the wide range of 30 to 300 degrees, different values of biasing resistor (R7 and R8) are employed in the Computing Thermometer. These values of resistance are switched in by S2. The two positions of S2 are labeled: BELOW 60 DEGREES and ABOVE 60 DEGREES, respectively. For accurate readings set S2 to the corresponding position. Generally speaking, a few minutes of experience with the use of the thermometer will be all that is needed to learn its operation. Remember that the lamps tell you where to position R5's knob. If the knob is correctly positioned both the red and the green lamp will be on with equal brilliance. If you are slightly higher or slightly lower than the correct temperature, one or the other lamp will be brighter, and if you go beyond that point, one lamp will go out completely, indicating

Resistance-vs-temperature chart for calibrating thermometer scale

RESISTANCE SETTING OF R5	TEMPERATURE EQUIVALENT
2500 ohms	30 of
2400	32
2300	35
2100	40
1900	45
1700	50
1500	55
1300	60
1175	65
1060	70
940	75
820	80
710	85
675	90
615	95
550	100
500	110
450	120
350	130
240	140
215	150
180	160
130	180
95	200
80	212
70	220
55	240
40	260
32	280
25	300

that you should appropriately reset the control knob to recapture the exact reading. In this way, you can determine the magnitude of error if you are monitoring for a constant temperature, as well as the direction of the change.

If you are interested in a narrower temperature range the scale can be expanded or a particular portion of it can be selected. For example: a 1500 ohm fixed resistor in series with a 1000 ohm potentiometer will give you a 30 to 50° F. scale, over a 300° arc. You can also go lower than 30° F. A 2400 resistor and a 1000 ohm pot should get you down way below 0° F.

Any number of probes can be used (one at a time) to read the temperature at various locations using only one indicating device. ■

Parts list for computing thermometer

D1-D4—Silicon Diode, G-E type 1N5059 or 1N5060
D5 —Silicon Diode, G-E type 1N645
I1 —12V, 100 ma. Indicator Lamp with red lens (Industrial Devices, type B3063D1)
I2 —12V, 100 ma. Indicator Lamp with green lens (Industrial Devices, type B3060D2)
J1 —Panel-mounting jack (Amphenol, type 80-PE2F)
P1 —Cable-type plug (Amphenol, type 80-ME2M)
R1, R2—1.8K, ½W, resistor, ± 10%
R4 —Glass Probe Thermistor, 1K @ 25°C (Fenwal Electronics)
R3, R6—15K, ½W resistor, ± 10%
R5 —2.5 Wirewound potentiometer, linear toper (Clarostat, type A43-2500)
R8 —150K, ½W resistor, ± 10%
R7 —270K, ½W resistor, ± 10%
SCR 1—Silicon Controlled Rectifier, G-E type C106X1
T1 —12.6 volt filament transformer @ 1A or 2A (Stancor, type P-8384 or P-8130)
T2 —25.2 volt filament Transformer @ 1A (Stancor type P-8180)
S1, S2 —Single pole, two position rotary switches (Centralab, type 1460)

Miscellaneous:

Case: 7-inch x 5-inch x 3-inch Miniature Aluminum Case, gray hammertone finish (Premier, type PMC-1008).

Other: Phenolic perforated board, 1-inch standoffs, knobs, length of 2-conductor cable, probe body, 6-32 hardware, ground lugs, handle, calibration scale, wire, solder, line cord and plug, etc.

MEDICINE

Starvation and the very rich

by Arthur J. Snider

POVERTY is not the sole reason for malnutrition in the United States. The rich can be malnourished as well as the poor, says Dr. Cortez F. Enloe Jr., editor of *Nutrition Today*. They are less dependent on staples and more free to indulge in a wide variety of ordinary and exotic foods. The new enemy of good nutrition is "gourmetism," he contends.

Food habits that change as the standard of living rises are upsetting food fortification concepts which have been based on the assumption that the majority of people will consume foods at a constant rate.

Dr. Enloe cites enriched flour as an example. Bread was chosen as a vehicle for enriched flour because at that time most Americans were getting 40 percent of their daily calories intake in bread. Now consumption of bread has declined to the point where people are eating only half as much bread as 30 years ago. Sales of products made with enriched flour have hit an all-time low.

"To make matters worse," he says, "when we do buy bakery products, we frequently choose the 'convenience' types that are made with flour that is not enriched."

Milk is another example. It used to be the major source of vitamin D. Now people are drinking less milk and much of the milk they do consume is poor in vitamin D because it costs less.

Consumption of iodized salt has declined since reaching its peak in 1947. Now surveys are beginning to show a higher incidence of goiter in certain areas. Before the introduction of iodized salt in the early 1920's, goiter was so common that surgery for its removal was a weekly occurrence even in small-town hospitals. It was even a frequent cause of draft deferment in World War I.

Apart from poverty and affluence, mental illness can be an important cause of malnutrition, Dr. Enloe says. Homer Collyer, one of the wealthy Collyer brothers who lived as hermits in a decayed brownstone mansion in the Bronx, starved to death—a victim of mental illness of which starvation was a symptom.

Enlarging on this point, Dr. Rudolph H. Kampmeier of Nashville says many family physicians have seen a mother in prolonged depressive episodes, helpless, unable to cook, leaving her brood of youngsters eating what they might find or what the neighbors bring in until the father, if there is one, comes home and throws together a meal.

Death by oxygen

A desperate asthmatic patient who was having difficulty breathing one night told his wife as he strapped on an oxygen mask: "I'm going to have a good night's sleep tonight if it kills me."

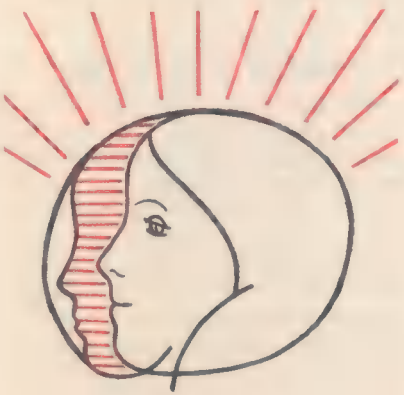
She found him dead in the morning, the oxygen mask still strapped to his face.

Dr. Murray Dworetsky of Cornell University Medical College cites the case in the *Southern Medical Journal* to illustrate the hazards of 100 percent oxygen.

The therapy should be used only if respiratory insufficiency is marked, he says, and only then with intermittent breathing of outside air.

Drug prevents sunburn

Tested by volunteers from Arizona State Prison walking in a hot desert, by skiers in the Swiss Alps and by swimmers on beaches, a sunburn lotion has been developed which may be the answer for fair-skinned per-



sons, according to scientists at Harvard Medical School.

It is a combination of two chemical formulas, each of which has been used in sunburn products for years but not in the right concentrations, reports Dr. Madhukar Parhart in the *New England Journal of Medicine*.

Most lotions just sit on the surface of the skin and are washed off by the first dip in the water. The new product is mixed with a high percentage of alcohol which carries protection into several layers of the outer skin.

The formula screens out the ultraviolet rays of the sun, providing protection from sunburn, skin cancer and aging of the skin, according to the *Journal* report.

While preventing sunburn, the formula also makes it difficult to acquire ■ tan.

One drug store p r o d u c t that matches the Boston formula is Block Out, the researchers say.

Defense of the human fetus

While codes have been drawn up to forestall unethical experimentation on human beings, there are no guidelines on experimenting with prenatal human life, Dr. Frank J. Ayd Jr., points out in *Medical Counterpoint*.

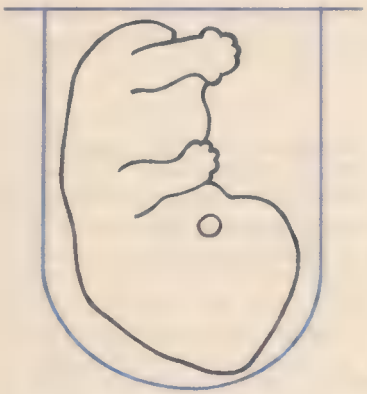
Venturesome dedication to the discovery, prevention and treatment of disease has produced "medical intranauts" who are exploring inner space of man before birth, even to the point of possibly altering germ plasm to pre-determine the sex of the child or to control his biological makeup.

"When genetic engineering is attempted, the risk of a mishap that may result in ■ defective human being or in death will have to be balanced against potential benefits," Dr. Ayd points out. "The pioneer decisions to proceed will be painful and awesome. So, too, will be the decision about what to do with the failures whose lives have been launched. Should they be allowed to live, or should they be destroyed?

"This raises afresh such crucial questions as: When does human life begin? Is it ever morally permissible

to terminate the existence of defective or unwanted human fetuses? What kind of society is it that would countenance the obliteration of anyone whose quality of life is below arbitrarily determined standards?"

Since it is almost certain the future will see an exponential increase in the number and types of experiments on human prenatal life, a code



of ethics should be formulated now, Dr. Ayd believes. The concept espoused by some that the "quality" of human life is more important than its presence and sanctity should be pondered, he cautions.

Mysterious middle-age spread

The pot belly, a common affliction of middle age, is produced by increasing deposits of fat in particular kinds of fat cells (adipose tissue) that form there, according to a consultant to the *Journal of the American Medical Association.*

Weak abdominal muscles and a sedentary occupation also contribute. So does stretching of muscles.

Why fat is selectively deposited in this region and certain other subcutaneous sites of the body is yet poorly understood, says Dr. Jules Hirsh of Rockefeller University, New York.

Dr. George F. Cahill Jr. of Harvard Medical School, notes that when full thickness grafts have been made in young males from the abdomen to the arm, for example, years later a marked and occasionally embarrassing protuberance of the arm develops at the same time as pot belly.

In general, the most recently deposited fat is the first to go in weight reduction. Thus doctors deem it important to begin dieting at the first signs of the pot belly. This should be combined with exercises to strengthen the abdominal muscles.

Nuclear brain surgery

Acting like an "atomic scalpel," a beam from a giant cyclotron has brought relief to many patients with acromegaly, a disease marked by coarsening growth of facial features, hands and feet.

More than 100 patients have been treated at the University of California's Lawrence Radiation Laboratory through exposure to the high energy particles emanating from the nuclear accelerator.

Acromegaly results from a nonmalignant tumor of the pituitary gland at the base of the brain, causing the gland to produce too much growth hormone. In addition to an overgrowth of features, the patients may have diabetes and severe headaches. Life expectancy usually is shortened.

For several years the disease has been treated by surgical removal of the pituitary. In more recent years,

radioisotopes have been implanted to destroy the pituitary.

At Berkeley, Dr. John H. Lawrence, a pioneer in nuclear medicine, began working with beams which could be directed with great precision to a small target in the body. He found that large doses of the radiation could be delivered safely to the pituitary area without damaging surrounding tissue.

Hysterectomy: pro and con

Thousands of hysterectomies are performed yearly for abnormal conditions in the uterus.

One view is that the ovaries, through secretion of female hormones, are essential to a woman's health, help keep her youthful and delay the menopause. The other view is that the ovaries continue to release eggs that have no place to go, so why keep them? Furthermore, the hormones could accelerate development of cancer, particularly in the breast or ovaries themselves.

In a mammoth study of 9,000 New York women who had hysterectomies between 1928 and 1953, Dr. Frank P. Pauloucek of Chicago has reached a preliminary conclusion that it makes no difference if the ovaries are left in or taken out. Results appear to be about the same.

Women who retained their ovaries at hysterectomy for a benign disease had no greater incidence of ovarian cancer and only a slight increase in breast cancer but no greater than might be expected.

Nor was longevity increased by preserving the ovaries.

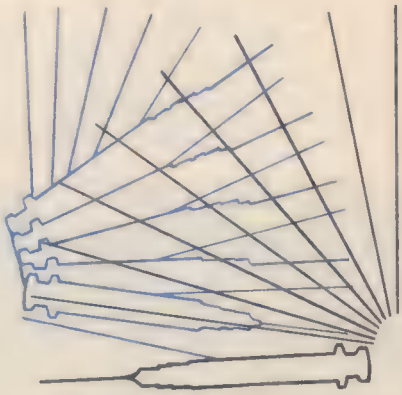
Dr. Paloucek, now medical director of the Cancer Prevention Center of Chicago, carried out the study at the State University of New York with Drs. Clyde L. Randall and John B. Graham. Another 1,500 women remain to be analyzed before final conclusions are drawn.

The new vaccines

With vaccines against three viral infections of childhood—measles, mumps and German measles—at hand, the prospects for additional vaccines are good, says Dr. Maurice R. Hilleman of the Merck Institute for Therapeutic Research.

Inroads against respiratory diseases are limited by the wide variety of viruses that produce them, he says. But progress is being made against specific agents. Influenza vaccines, for example, can reduce illness up to 90 percent and these are being made with more potency and purity.

A vaccine against chickenpox



should be ready for exploratory clinical trials in the near future. Viral hepatitis and infectious mononucleosis, currently believed to be caused by virus, are strong candidates for vaccine research. ■

MICRO-QUARTZ THERMAL INSULATION (above) prevents this girl's hand from being burned by a propane torch—even though the coin on her glove is being melted. Developed by the Johns-Manville Research & Engineering Center, the insulative material is only one-quarter inch thick. It is one of several insulations used in components for the lunar missions, including command and service modules, lunar module and mobile launcher.

RODENT REPELLENT FOR WIRES stops this rat from gnawing on the cable at the left. The untreated cable at right has been severely damaged by the rodent after only three days in a special test cage. Annual rodent damage to electrical and telephone cables has become a multi-million dollar problem. This repellent, developed by M & T Chemicals, Inc., a subsidiary of American Can Company is called "bioMet 12." It can repel rodent attack for up to five years, according to its manufacturer.

SEALING SEAMS ON ANY SURFACE is possible now because of a new sealant called "Acryl-R(R)." Above, the sealant is being applied to an oily aluminum window frame underwater to demonstrate that the sealant adheres to even the most difficult kind of surface under the most adverse conditions. Schnee-Morehead Chemicals, Inc., Irving, Texas, developed it with the help of the Cabot Corporation, Boston, Massachusetts.

ELECTRONIC CHIMNEY SWEEP (left) cleans particles out of stack gases in factories and power generating plants. It creates a charged zone that attracts the unburned products of combustion and prevents them from leaving the chimney and polluting the air. Developed by the Raytheon Company, Stamford, Conn., the electron tube, called "ML-100," may significantly reduce amount of air pollution from factory wastes.

BLOOD FROM 60 PEOPLE can be analyzed in only one hour thanks to a new device called "AutoAnalyzer," (left) developed by Technicon Science Center, Tarrytown, N.Y. The machine can perform analyses on whole blood, plasma, serum, urine or cerebrospinal fluid. The test samples go into sampling cups (as many as 40 patients at once can be tested). A proportioning pump forms a bubble of air between samples, moves part of each sample into the system. A chemical reaction occurs which is shown by a color change. The intensity of the color change is measured by a colorimeter or other methods such as spectrophotometry.

Why does the rattlesnak

EXPERTS CLAIM that the rattlesnake's rattle is a frightening device to ward off the reptile's natural enemies. But there are plenty of old wive's tales and just plain misconceptions floating around about the percussive creature—in spite of what authorities say.

To prove that the rattle is neither a warning signal among other reptiles (they are deaf) nor a hypnotic weapon against its prey—nor any of the other misconceptions surrounding the animal—photographer Kurt Severin joined Ross Allen at his Reptile Institute in Silver Springs, Fla., in a unique project.

On a portable tape recorder they recorded the rattle of an Eastern Diamondback Rattler from Florida. They then systematically exposed numerous animals to the sound, among them monkeys, rodents, various ruminants and several other species of reptiles. The tape was provided with a silent-run at the beginning of the recording in order to make it possible to place the instrument in a strategic position. The recording could be clearly heard over a radius of about 30 feet.

The animals that reacted the most hysterically to the sound were small mammals like rodents and other related species. But other animals are almost as afraid as these pictures show. ■

Photos by Kurt Severi

ke rattle?

verin

The startled look on this woman's face is the result of Ross Allen and Kurt Severin's portable tape recording of a rattlesnake. The sound produces instant terror in the right surroundings (she is standing in front of a food stand that sells snake meat). Allen and Severin (below) are making a recording of a six-foot Eastern Diamondback Rattler. It was this same recording that produced behavior like that of the monkeys and raccoons at right. Raccoons are the snake's natural prey and so react with utter terror. Monkeys are just easily scared by any peculiar sound. The deer below were stampeded at first when the tape recorder was placed in their midst. Later, however, they became used to the sound and showed no fear. Deer in the wild have been known to kill rattlers with their sharp hooves when threatened.

QUIZ

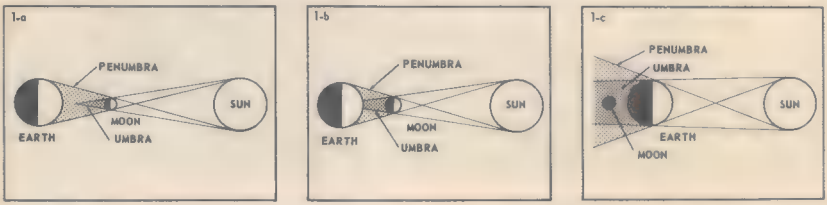
How good are you as an astronomer?

by John and Molly Daugherty

NOW THAT MAN HAS LANDED ON THE MOON, we envision many uses for the moon site. For instance, the establishment of an observatory on the moon would let us see the universe without the handicap of an atmosphere. This would advance astronomy greatly.

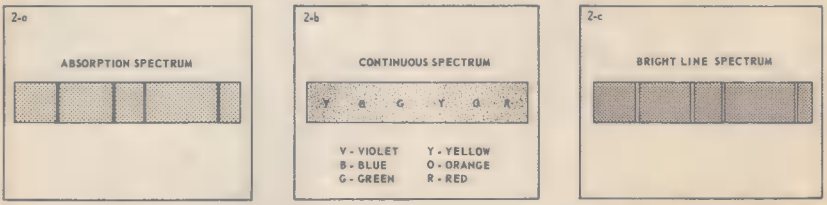
What do you know about astronomy?

1. The orbit of the earth lies in the *plane of the ecliptic*. A line through the center of the sun and the center of the earth is on this plane. The orbit of the moon around the earth is tilted five degrees from the plane of the ecliptic. Because of this tilt, conditions are not right for eclipses of the sun and the moon every month. Choose the picture which shows a *total* solar eclipse.



2. There are three classes of spectra: continuous, bright line and absorption line. A white hot solid gives a continuous spectrum of all colors. Gases at high temperature or electrically excited produce bright line spectra. If the source emitting bright line spectra is surrounded by the same gas but cooler, this gas absorbs the colored lines and leaves dark lines in the same position.

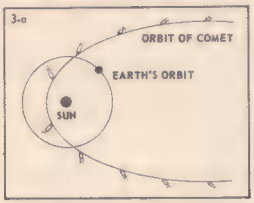
In 1814 Fraunhofer made an important discovery when he observed the spectrum of the sun. Choose the picture which shows the type of spectra Fraunhofer discovered in the sun.

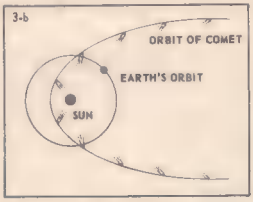


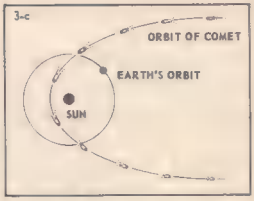
3. Comets have always made a great impression on men. In early times they were considered bad omens associated with all sorts of disasters and events (See "The sky is falling," June 1969, page 14). The comets with elliptical orbits return periodically. Others with parabolic or hyperbolic curves will

never return. Halley's comet appeared in 1910 and will return in 1985.

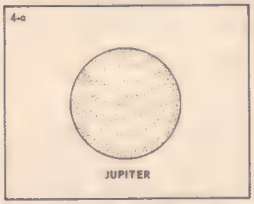
Choose the picture that shows the correct orientation of the head and tail of the comet as it orbits the sun.

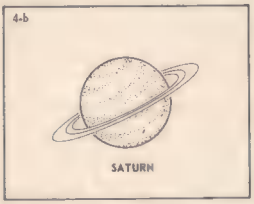


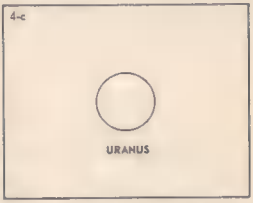




4. All nine of the major planets in the solar system revolve around the sun counterclockwise as viewed from outer space. Eight of the planets rotate on their axis in the same direction—counterclockwise. One planet, an exception, rotates clockwise on its axis. Choose the picture of that planet.

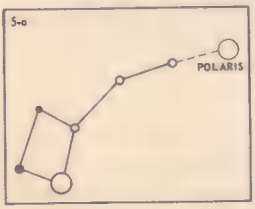


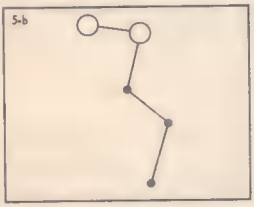


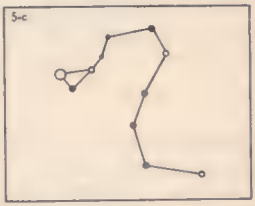


5. The Greeks, like the Egyptians and the Chinese, divided the sky into constellations. These 88 configurations of stars are still useful. Many of the names originated with the Greeks, but are Latin translations. The names given the constellations, however, seldom resemble the animals or persons or things for which they were named. Probably the Greeks named star groups to honor people, animals and things.

Choose the picture that shows the constellation Draco (the Dragon).







Drawings by Sam Sims

Answers:

1—b A *total* solar eclipse occurs when the moon is near perigee and the earth near aphelion. Perigee is the position of closest approach of the moon to the earth—about 221,600 miles. Aphelion is the position of the earth at its maximum distance from the sun. The shadow of the moon is cone-shaped and at the surface of the earth covers a circular area with a diameter of

about 167 miles. To the observer, the shadow may last about seven minutes.

In 1—a the moon is at apogee (about 252,970 miles from the earth), and the cone of the shadow isn't long enough to reach the earth. Such an eclipse is an *annular* eclipse. In 1—c the eclipse is a lunar eclipse.

2—a Absorption line spectra. In observing the "continuous spectrum" of the sun, Fraunhofer, who invented a forerunner of the modern spectroscope, detected numerous dark lines crossing the field of colors. He made a map of 576 of these lines. The picture shows four prominent *absorption* lines of the element mercury in the sun. A *bright* line spectra of mercury would show various colored lines in the same positions. So far 67 of the elements found on earth have been identified in the sun's dark line spectra. In fact, helium was identified in the sun 20 years before its discovery on earth. Every element has a distinctive pattern *bright* line spectrum as to number of lines, color and placement. The sun's interior produces them but the envelope of hot gases around the sun is a little cooler, permitting the absorption of these wavelengths and the re-radiation of them in *all* directions. The re-radiation in our direction is too faint to be seen—hence the dark lines.

3—a As the comet approaches the sun, the tail is behind the head and points away from the sun. As the comet recedes, the tail still points away from the sun, which means that the tail is now in front of the head. The radiation pressure from the intense activity of the sun supplies the force or forces to push the tail away from the sun. When the comet is close to the sun, it grows brighter and becomes larger. The tail of Halley's comet reached a length of about 94 million miles. At great distances from the sun, the bright coma and tail of the comet shrinks.

4—c Uranus rotates clockwise on its axis. All the other major planets rotate counterclockwise. The five known satellites of Uranus also revolve about it clockwise. Uranus is unique. Its axis tips 98 degrees from the perpendicular to its orbit plane. The earth tips 23½ degrees from the perpendicular to its orbit plane (the ecliptic plane). Because the axis is tipped so greatly, when we look at Uranus during parts of its revolution, we look at its polar ends—one or the other.

5—c This is the constellation Draco (the Dragon). The various sized circles in the configuration refer to star magnitude, the brightness rather than the size. For example, a large circle if black is first magnitude; if white, is second. Small black circles indicate third magnitude, and small white, fourth.

In 5—a the constellation is Ursa Minor or Little Dipper. Its handle points to Polaris, the star over the north pole of the earth's axis.

In 5—b the constellation is Cassiopeia or Queen of Ethiopia.

Score yourself:

4—5 right	Your score is skyhigh
2—3 right	This score puts you in a large constellation
0—1 right	You're hardly ready for a moon landing

a wonderful way to say

Merry Christmas

GIVE SCIENCE DIGEST

250 WEST 55th STREET • NEW YORK, N. Y. 10019

1 one-year gift subscription $5.00
2 one-year gift subscriptions $9.00
Each additional one-year subscription . $4.50

Enter the following one-year gift subscriptions, and mail your attractive gift announcement card:

I enclose $_____ ☐ ***Bill me $_____** ☐

**After January 1, 1970*

NAME _____ *(Please Print)*

ADDRESS _____

CITY _____

STATE _____ ZIP CODE _____

NAME _____ *(Please Print)*

ADDRESS _____

CITY _____

STATE _____ ZIP CODE _____

SENT BY: _____ *(Please Print)*

ADDRESS _____

CITY _____ STATE _____ ZIP CODE _____

GIFT CARDS TO BE *Signed* _____

Also include my own subscription ☐

Canadian, Pan-American and Foreign subscription prices on request.
Gift card will arrive in Christmas mails.

XD | 9J1

BIPS Photos

How to make a lamb in police dog clothing

PSYCHOLOGICAL conditioning can transform this snarling, vicious police dog into a gentle pet with the disposition of a lamb, as the following pages show.

"It's all done with a blend of sympathy, intelligence and discipline," says British dog-trainer Richard Brightman who has conditioned hundreds of violent dogs to become quiet and obedient.

When this dog makes a lunge for three grazing sheep, Brightman yanks hard on the choker chain collar. The

dog learns to associate the sheep with an unpleasant experience, as above, and after several weeks of conditioning gives up sheep-chasing. The dog is also rewarded lavishly whenever he does something right: showing affection, not barking, obeying Brightman's commands.

The whole procedure of conditioning the animal's behavior is long and sometimes tedious, but the results are gratifying: first, getting the dog to take a walk with a lamb (at right) —and then graduating to things like a cool bottle of milk, a quiet nap. ■

MEDICINE

New clues to the diabetes riddle

by
Joseph D. Wassersug, M. D.

WITH THE discovery of insulin almost 50 years ago, many doctors firmly believed that the problem of diabetes was practically solved. Scientists learned that insulin, a hormone secreted by the pancreas, controlled the level of blood sugar; when a person's pancreas was deficient in its secretion of insulin, his blood sugar level rose and he became diabetic. It all seemed as simple as that. Doctors believed then that a little more research into the chemistry of insulin would solve the diabetes problem completely.

Time has proved, however, that those early hopes and guesses were too optimistic. The chemistry of diabetes has turned out to be far more complicated than a simple mathematical relationship between insulin and blood glucose (sugar).

The diabetic specialist of today needs not only to be a topnotch organic chemist but also a physiologist, a nutritionist, an enzymologist and an electron microscopist. He needs to know about body lipids (fats), fatty acids, intricate intracellular structures and has to be able to probe the secret ways tissues have for storing and dispensing a multitude of hormones and enzymes. Yet, in spite of its complexity, the problem of diabetes is being solved.

Although *insulin* is not the whole answer to the diabetes problem, it still remains a major clue.

Insulin is manufactured in certain cells—the *beta* cells—of the pancreas and stored in the *beta granules* within those cells. It is so potent a chemical that it is found normally in the fasting blood plasma in the dilution of about *one part per billion* and its concentration rises to about five parts per billion after a meal. Because it is present in such tiny amounts doctors do not yet have a simple chemical method for measuring the insulin in the blood.

In spite of a vast amount of research, doctors do not yet know exactly how insulin is carried through the bloodstream and how it exerts its many different physiologic effects on the tissues of the body. Some scientists think that insulin is "bound" to some other proteins in the blood and that this is why it is so difficult to develop a simple chemical method for measuring blood insulin levels.

Best current estimates are that a normal man makes at most one to two mgms. of insulin every 24 hours and that its "half-life" in the blood is no greater than 10 minutes. In these 10 minutes, before the insulin molecule is broken down and rendered inactive, it must regulate blood sugar, store glycogen in muscles and liver, prevent mineral losses, keep the stored fats from disintegrating into fatty acids and help synthesize new proteins. For a rather small protein molecule, insulin has a gigantic task in the economy of the body. Under normal circumstances it does its job very well indeed.

Along with the recent tremendous increase in understanding of insulin chemistry and carbohydrate (glu-

cose) physiology, the practicing physician has also been given newer and better medicines to treat the diabetic patient. Although insulin still remains the best medicine for the younger diabetic, adults, especially those over 45, can often best be treated with tablets or capsules taken by mouth. Today the doctor has a half-dozen or so compounds that can effectively control diabetes in most adult patients. In some cases, indeed, the results may be superior to those obtained with insulin.

The first major clue to the discovery of oral anti-diabetic tablets came in 1942 when discerning scientists observed that there was a lowering of blood sugar in those patients who were taking sulfa drugs to fight infection. Following this lead they were gradually able to develop chemical derivatives of sulfa that had less germ killing effect but were more potent in diabetes.

Four medicines that doctors now use—orinase, diabinese, dymelor and tolinase—are all modified sulfa drugs. Although they differ from each other in chemical composition, they are believed to act mainly on the pancreas causing it to deliver more insulin into the bloodstream.

The anti-diabetic compound that is fascinating many medical doctors at present is not a sulfa but *phenformin* (DBI) because it is chemically and physiologically different from the others. More like insulin and less like the sulfa-derivatives, it apparently doesn't whip a tired old pancreas; rather, it helps to store glucose in the muscles of the body. By such storage, excess glucose is removed from the blood and more normal levels are achieved.

Because of its special physiologic effects, DBI seems to be developing a unique place for itself in the treatment of the overweight adult diabetic. According to diabetes experts, Drs. C. Weller and M. Linder, "The majority of diabetic patients are not insulin deficient." Instead, they and many other specialists believe that there are normal amounts of insulin secreted by the pancreas (in the adult) but the action of the insulin is *blocked* somewhere along its path before it can be normally utilized by the tissues of the body.

Some scientists have demonstrated, indeed, that the stable adult diabetic may even be delivering more than normal amounts of insulin into his bloodstream. Since the muscle uptake of glucose is diminished in these cases its concentration in the blood increases.

When this happens the body is caught in a dangerous vicious circle. When the muscle fails to store glucose, blood sugar rises. When blood sugar rises, more insulin is secreted. When more insulin is secreted, appetite increases and storage of sugar *into fat* increases. Consequently the obese diabetic being treated by insulin or responding to his own increased secretion may become fatter. This observation, which was once puzzling to doctors, now seems logically explained. It explains, too, why four out of five diabetics are obese.

Phenformin gets around this obesity problem by increasing glucose utilization in the diabetic's skeletal muscles. It has little or no effect on the pancreas or on the fatty storage tissue. Some diabetics on phenformin may actually lose weight gradually. Or, at least, may not gain additional weight. For example, in a group of 17 diabetic patients on phenformin

studied by Dr. John F. Seidenstricker and the late Dr. George J. Hamwi of the Ohio State University Hospitals, not only was weight stabilized but there was also a significant lowering of both the sugar and cholesterol concentrations in the blood.

Today, then, the doctor who cares for diabetic patients has a much greater choice of treatment available to him than ever before. First, he has a variety of insulins, ranging from those that are quick and brief in action to others that are moderate or actually slow and long-acting. The tablets that the doctor uses can also be varied depending on whether the patient's needs are better answered by a long-acting or a short-acting drug, or one that works on the muscles or on the pancreas. Diet, a mainstay of treatment, is also more easily achieved through the greater availability of standard charts and sugar-free foods and beverages.

It must be admitted, nevertheless, that in spite of the tremendous gains of the past decade some significant problems still remain. First and foremost, perhaps, is the current lack of a universally acceptable definition of such terms as *early diabetes, pre-diabetes* and *chemical diabetes*. Everyone agrees that diabetes exists when the blood sugar is *high*. What bugs the experts is trying to find the exact point where high is just *normally* high or where it is *abnormally* high. It's like trying to decide how many inches tall a man must be before you really call him tall.

According to Dr. Clarence Cohn of the Michael Reese Hospital and Medical Center (Chicago), the "normal" fasting (before breakfast) blood sugar varies from 75 to 105 mg per 100 cc. Since the "fasting" blood sugar is not really a very sensitive test, many doctors nowadays prefer taking a blood specimen two hours *after* breakfast (or lunch) and, if the reading is over 150 mgm per 100 cc, diabetes can *usually* be diagnosed.

But even here Dr. Cohn urges caution. Diabetes is not the only condition that can increase the sugar concentration of the blood. Other possible factors are low blood oxygen, anesthesia, convulsions, some brain disorders, corticosteroids and certain liver diseases.

Before a doctor makes a diagnosis of diabetes, therefore, he must take many other factors into consideration. The doctor may prefer to get several blood sugar tests before starting treatment. Dr. Howard J. Christian, pathologist and director of laboratories, Carney Hospital (Boston), agrees with this approach. "Great caution," he says, "should be exercised on diagnosing diabetes, or excluding it, on the basis of a single glucose test. In fact, in some cases, it may be necessary to conduct a number of tests over a period of time under varying conditions of stress." Before making a diagnosis of diabetes every case must therefore be thoroughly and carefully evaluated.

Nowadays doctors are not content, however, with finding and treating only established cases of diabetes. What they seek are methods for detecting diabetes before classical symptoms—increased hunger, increased thirst, weight loss, fatigue and itching—are present. Hope and expectation exist that if cases can be found in the "chemical" stage of diabetes or in the "pre-diabetic" form, suitable action could be taken to *prevent* the damaging effects of the disease later in life. ■

Three Lions Photos

Diet is a major concern with diabetics, as the dietician is explaining here to the recently diagnosed diabetic. Certain starches and all sugar-sweetened foods can be quite detrimental to the diabetic. But with so many sugar-free foods and beverages today, he can still enjoy many drinks and desserts once prohibited to diabetics.

Insulin injection must be taught to the diabetic so he can do it without help. While insulin still remains the best medicine for younger diabetics, much success has been had with new oral medicines that come in tablet form. It must be remembered, though, that neither insulin nor other drugs are cures—they merely control.

On a return visit, the patient is weighed to see if any radical weight change has taken place since his last visit. Four out of five diabetics tend to be overweight because of their body chemistry, but new drugs are making progress in alleviating this.

Mario Villa is working with a hide that has been stretched out to dry after going through the tanning shop. The crock in front of him is the kind that is used to soak the skins during several steps in the tanning process at the Field Museum in Chicago, Illinois.

Tanning animal hides: how the experts do it

by Patricia M. Williams

TANNING HIDES is a fascinating, foul-smelling, rewarding, messy business; and it takes years of practice (usually on small animals like skunks and beavers) before you can really do it well—assuming that you can manage to ignore the overwhelming pungency of the hides long enough to *learn* the craft.

And it takes a special kind of person—someone like Mario Villa of the Field Museum in Chicago—to master the ancient trade of hide-tanning. He learned how from his father Dominick who tanned hides at the museum for more than 30 years.

Although most of the skins Mario prepares are dried and shipped to the museum from field associates, occasionally the entire carcass of a zoo animal may be delivered to the shop. After the dead animal is skinned, Mario puts the skin into a crock of brine where it remains for two or three days to remove the "slime." Those skins that arrive dried are put into soak water, a mixture of car-

bolic acid and water, for a few hours or a few days, depending upon the size of the skin. This soaking renders the skin limp and pliable. From this point on, both the dried and fresh skins follow the same procedure.

The tanner, Mario, sits before a large blade with a sharply-honed edge and passes the skin over it to remove the membrane. This process is known as "fleshing." The larger hides are laid across a shaving beam and shaved with a large two-handled knife called a currier's shaving knife. Both the shaving and fleshing require a "touch" or "feel" that comes only with experience. Too much pressure can tear the skin or release the hairs on the opposite side, resulting in a bald spot. Too little pressure, of course, will fail to get the job done. Each different kind of animal skin —fox, cheetah, or rhino—requires a different amount of pressure that the tanner must determine by "feel."

If the skin is greasy after it is fleshed, it is washed in soap flakes and rinsed thoroughly. Next, the skin is pickled for at least three days to make it more receptive to the tanning solution. When the three days have passed the skin is shifted from the pickling crock to the tanning crock where it remains for at least a week. While in the tanning solution, the skin must be stirred several times a day to insure that the solution reaches all parts of the hide properly.

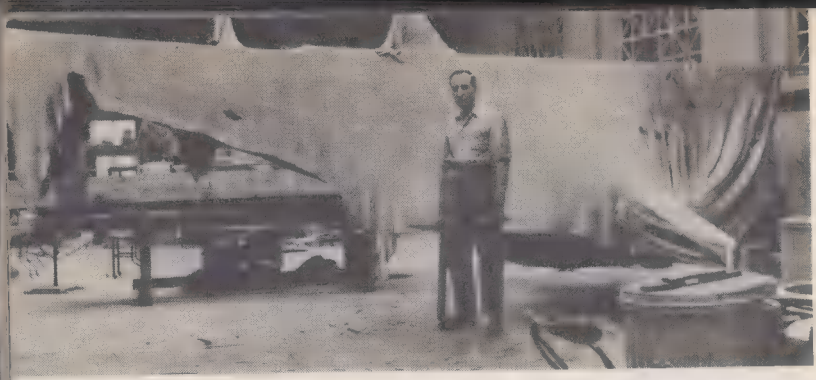
When the skin is removed from the tanning solution it is no longer a raw skin. It is then drained and oiled with neat's foot oil on the flesh side and a few days are allowed to let the oil "dry in." In the past, tanners coated the hide with butter, lard or vegetable oil and the *Handbook of Museum Technique* states that the "Red Indians used the brain of the killed animal" to lubricate the skin.

At this point in the procedure approximately eight days have passed, depending upon the skin, and the end is not yet in sight. The skin is now dampened on the flesh side with a sponge soaked in carbolic water, which prevents mold, and placed in a sweat box to permit the dampness to penetrate it thoroughly.

On removal from the sweat box, the skin is staked, a process that opens the pores by stretching and pulling. Small skins may be pulled back and forth over the fleshing knife, but big skins are tied to a board with a small loop and vigorously pulled and stretched by hand.

The *Handbook of Museum Technique* instructs that at this point the tanner should "Place the hide in a barrel or basin and tread for two

This machine is called a kicker because it literally "kicks" the skins until they are soft. Years ago this part of the tanning process was done by stomping the skins—by foot.



Dominick Villa was once assigned the job of tanning a 25-foot long whale-shark (above). The stench from the tanning shop was so strong while he was working on it that museum official Stanley Field insisted that the whale-shark be moved to the basement—well out of smelling range. But Dominick kept at it and finished the job. The giant is now a part of one of the museum's thousands of exhibits.

The softness and pliability of a skin depends on how effectively the tanner is able to wet and shave the flesh side. At right Mario Villa is shaving the skin a second time after it has been stretched, dried, oiled and run through the kicker machine. This is the finishing touch on the skin as far as the tanning shop is concerned. The next step is to move it along to the taxidermist or to the study collection.

hours or more with bare feet, turning the hide over and over. This works the vegetable oil or butter into the hide and softens it with the warmth of the feet. Kick it around and tread it thoroughly to work the oil well into the hide." Years ago, Dominick Villa did stomp the skins with his feet, but the ubiquitous machine has made this unnecessary. If it is necessary to further soften the skins, Mario places them in the kicker, a strange looking wooden machine that literally kicks the skins until they reach the desired softness.

While the skins are slightly damp, they are put into the sawdust drum, located right next to the kicker, and tumbled about for a couple of hours. Finally, they move to the cage—an eight-foot high, screen-enclosed wheel in which the sawdust is "caged out" of the fur. These three machines, the kicker, the drum and the cage, are all housed in a rather small, dimly lit room that looks like the local branch office of the Inquisition, replete with the latest thing in torture racks.

Fine-haired skins must be combed out and brushed when they come out of the cage. The original identification tag is attached to the skin and it is now ready to join thousands of others in the museum's enormous study collection.

If a skin is to be mounted by the taxidermist, it undergoes an abbreviated procedure known as "dressing."

Although Mario is quite modest about it, there is considerable difference between his tasks as a tanner at

A cheetah skin (above) is being pulled out of the rotating sawdust machine where it has been tumbled to completely dry and clean it after the tanning process. Fine-haired skins must be brushed and combed at this point to remove any foreign particles and to soften the fur before they go into storage with thousands of other exotic wild animal skins.

the museum and those of a tanner in a furrier's shop. A furrier's tanner usually does no work on the head and legs of an animal skin, whereas Mario must carefully remove the cartilage from the ears, slit the eyelids and include the head and leg skin in the tanning process. If he should shave the skin too closely, the animal's whiskers will drop off. If he multilates the head in any way, the scientific value of the skin declines. Mario must also remove the leg bones, keeping intact the claws or hoofs of the animal. Also, a furrier's tanner may only work with a few different kinds of pelts, for example, fox or beaver. This tanner then follows very nearly the same procedure daily—the shaving technique is the same, the amount of time the skin is

Hides are classified and stored on racks in one of the museum's two "skin rooms," each about 40 feet long and containing thousands of skins. Below can be seen part of the Field Museum's collection of skins; tiger and leopard skins are included in this view of one part of a skin room. This collection is known and respected all over the world.

in the crocks is the same, etc. Mario works on everything from a squirrel to a rhino and must be familiar with the tanning requirements of each.

Sound like an interesting job? The Villas think so—they've even tanned the hide of a 25-foot long whale-shark. Now *that's* interesting! ■

For further reading

TANNING PROCESSES. *August Carl Orthmann. Chicago Hide and Leather Pub. Co. 1945.*

Jawbones indicating man's age to be over 14,000,000 years are examined by Yale scientists David Pilbeam (left), Elwyn Simons.

Man is over 14,000,000 years old

MAN'S ANCESTORS branched away from the apes some 14 million years ago, six million years *later* than the figure proposed by archaeologist Louis B. Leakey, claim two *Yale University* scientists. They've identified two fossil lower jawbones in museums in London and Calcutta as belonging to a 14,000,000-year-old creature called Ramapithecus, who apparently used his teeth much as modern man does.

Drs. Elwyn L. Simons and David R. Pilbeam declare that they've established a distinct evolutionary relationship between the Australopithecus, a near-man who lived from one to 5 million years ago, and Ramapithecus, a near-pre-man who lived between 8 and 15 million years ago. Ramapithecus, declares Dr. Simons, is definitely a "hominid," but the fossils discovered in Africa by Dr. Leakey are "clearly an ape, unrelated to Ramapithecus."

Dr. Leakey declared in 1967 that his fossils were hominids and ancestral to Ramapithecus, which he calls Kenyapithecus.

The Simons-Pilbeam theory is based on resemblances between the eating apparatus of the Australopithecus and Ramapithecus. Both hominids apparently had developed an

improved ability to chew tough foods like roots, nuts and seeds. Their jawbones were thicker than apes' and there were no gaps between the teeth, among other features. Apes have the dental equipment to chew the soft berries and fruits they prefer.

The dental wear in both Australopithecus and Ramapithecus decreases toward the rear of the mouth, suggesting that their second molars and wisdom teeth came in late, just as man's do. The tardy arrival suggests a prolonged adolescence in which the hominids had the time to learn.

One of the fossils identified by the Simons-Pilbeam team was discovered in India in 1928 and the other in West Pakistan a few years later.

Trouble with Carbon 14

Carbon 14 dating, an enormous boon to scientific investigations of the past, has developed a "credibility gap." Discrepancies have appeared between the ages assigned to objects by Carbon 14 analysis and those established by other techniques. Carbon 14 dating of objects from the early Egyptian dynasties, for example, where age can be established from king lists, seems to be off as much as 300 to 500 years. All the errors seem to be in the direction of making the object too young. Now a group from the *University of Pennsylvania* has received a grant to tackle the problem. They'll use samples of bristlecone pine of known age to try to figure out the magnitude and duration of the periods of fluctuation.

Bear and seal relatives?

The bear and the seal may have had a common ancestor, two young investigators at *Texas A&M University* suspect. Doctoral students David Atkins and Dan England, who have studied the brains of 200 carnivores, have found that both the bear and seal have a pyriform with a peculiar twisted placement. The pyriform is a lateral lobe of the brain that extends smoothly alongside the brain features in other orders studied. "The interesting question is—did this happen by chance or did the seal and bear evolve from an earlier mammal

Walrus brain is being studied by Texas A&M graduate students in a project on mammal classification by brain structure. This brain is one of 200 specimens they have studied.

which had this structure," comments England. He and Atkins hope to answer this with further research.

Tsunamis in miniature

The generation of "impulse waves" in an 84-foot-long tank at the *University of Chicago* has convinced geophysicist Robert L. Miller that all such waves are similar. An impulse wave is a wave that originates from a sudden strong pressure, such as an underwater explosion.

Miller produces his waves with an aluminum plate, recording the results with a camera and electronic graph. By increasing the energy, he can transform a mild wave into a miniature "tsunami," the violent wave (sometimes misnamed "tidal wave") that wreaks havoc on people and property (see *Science Digest*, Feb. 1968 and Jan. 1969). "Most important," he notes, "I have observed and photographed zones of transition from one wave type to another." After rising to tsunami proportions, the big wave gradually reverts to its original form.

Current practice is to distinguish four distinct kinds of impulse waves, none of them related to each other.

Hostile astronauts

How will astronauts fare psychologically on lengthy space flights? Judging from the experience of men who have been isolated together, certain problems will arise, suggests Dr. S. B. Sells of *Texas Christian University*. Since it's of paramount importance to be accepted by the group aboard the space ship, astronauts may vent hostilities on authorities back at the home base. "Some occurrences of this type have already been seen in the space program and may be expected with greater vehemence as distances increase," notes the psychologist. Other threats: a weakened command structure due to enforced intimacy and a drop in feelings of security that depend largely on support from family, familiar people and surroundings.

Fat rats infertile

A link between high body fat content and infertility has been discovered by *Michigan State University* nutritionists, and they think the same link might exist in humans. They fed a high-fat diet to two groups of rats, one of which was limited in the amount of food it could eat. A third group got only grain. A whopping 90 percent of the rats on the unlimited high-fat diet were infertile. Eighty percent of the rats on the limited high-fat diet were sterile. The body fat content of the rats seemed to jeopardize the fertility of the female more than that of the males.

Glass jaw is stronger

The glass jaw, a favorite metaphor for sportswriters describing a prize fighter who can't take a punch, may be stronger than a natural jaw of bone. That's the word from the *University of Florida*, where Dr. Larry Hench, an engineer, is working with ceramic glass implants to which the natural bone will attach itself and grow. Human tissue will not attach to the metals used in today's surgery. If the ceramic glass performs as expected, doctors may be able to replace bones damaged by accident or disease with glass bones. ■

ISAAC ASIMOV EXPLAINS

Each month Dr. Isaac Asimov chooses one of the questions you send in to answer. He does not make the job easy on himself, for in past months he has written about such things as relativity, parity and the basic nature of light.

A neutrino is a neutrino

Are neutrinos matter or energy?

In the 19th century, scientists assumed that matter and energy were two entirely different things. Matter was anything which took up space and which possessed mass. Because it had mass, matter also had inertia and responded to a gravitational field. As for energy, that did not take up room and did not have mass, but it could do work. It was further felt that matter consisted of particles (atoms) whereas energy often consisted of waves.

Furthermore, 19th century scientists felt that matter could neither be created nor destroyed, and that energy could neither be created nor destroyed. The total quantity of matter in the universe was constant and so was the total quantity of energy. Thus, there was not only a law of conservation of matter but also a law of conservation of energy.

Then in 1905, Albert Einstein demonstrated that mass is a very concentrated form of energy. Mass could be converted to energy and vice versa. All one had to take into account was the law of conservation of energy. That included matter.

What's more, by the 1920s it became clear that one couldn't speak of particles and waves as though they were two different things. What we ordinarily consider particles act like waves in some ways. What we ordinarily consider waves act like particles in some ways. Thus, we can speak of "electron-waves," for instance; and we can also speak of "light-particles," or "photons."

There still remains a difference. Particles of matter can be at rest relative to some observer. Even though at rest, they possess mass. They have a "rest-mass" over zero.

Particles such as photons, however, have a rest-mass of zero. If they were at rest relative to you, you could measure no mass at all. This is purely theoretical, though, for particles with a rest-mass of zero can never be at rest with respect to you or to any observer. Such particles must always travel at a speed of 186,282 miles per second through a vacuum. As soon as they are formed, they dash off at that speed.

It is because photons always travel at 186,282 miles per second (through a vacuum) and because light is made up of photons, that we speak of this as the "speed of light."

Well, what about neutrinos? They are formed in certain nuclear reactions and no atomic physicist has yet been able to measure their mass. It seems quite likely that neutrinos, like photons, have a rest-mass of zero.

If so, neutrinos always travel at 186,282 miles per second through a vacuum and assume that speed the instant they are formed.

Neutrinos are not photons, however, for the two have quite different properties. Photons interact very easily with particles of matter and are slowed down and absorbed (sometimes very quickly) when they pass through matter.

Neutrinos, however, hardly interact with particles of matter at all and can pass through whole light-years of solid lead without being much affected.

It seems clear, then, that if neutrinos have a rest-mass of zero, they are not matter. On the other hand, it takes energy to form them and they carry energy off with them when they leave—so they *are* a form of energy.

Still, they pass through any matter that exists with scarcely any interaction at all; so they do virtually no work. That makes them different from any other form of energy. Perhaps we had better just call them—neutrinos. *—Isaac Asimov*

Please address all questions to Isaac Asimov Explains, Science Digest Magazine, 575 Lexington Avenue, New York, N. Y. 10022

"Come on, Jarvis. There's nothing here!"

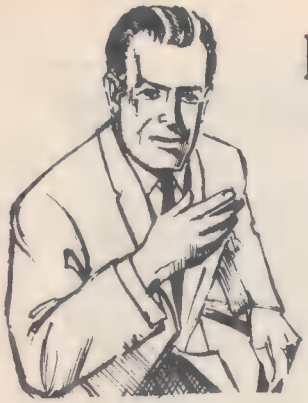
Little package, big kick

NUMBATS AND PEOPLE generally don't mix. The tiny Australian marsupial ant-eater is very shy and stays away from any area where there are signs of man. The animal prefers to live in areas where wandoo (white gum) trees grow. The wandoos are homes for termites, on which the numbat feeds.

When one is captured, it's generally a great struggle at first. Even though the animal weighs less than two pounds, he is quite sturdy and packs a strong kick—which always comes as a harmless yet stunning surprise to his captor.

This one was captured during the making of a movie about the species. A team from the Australian Commonwealth Film Unit went into Western Australia for two weeks to film this numbat along with his mate and three offspring. After the film was completed, the numbat family was taken to live in the Taronga Park Zoo in Sydney. The photographic team discovered that although the numbat is shy at first and puts up a terrific battle, it soon gets used to people and becomes an affectionate pet.

And the feeling is mutual with people. It's easy to get attached to the little brown and white animals, even though it's a bit rough at first. ■



Do your friends come to you for answers to their questions?

Do you seem as destined as I am to be sought out by those who are puzzled, or troubled, or who need advice?

"When the Barkers came to me they were desperate. They had talked to many people and read many books without being helped.

"Then I remembered a point in the Astara lessons I was studying which gave me the insight to see and explain the cause of their problem. And in a few moments they thought of the solution themselves.

"It made such a profound change in their lives that they never stopped thanking me, and they're always telling others what I was able to do for them.

"My own gratitude goes to *Astara's Book of Life,* the Degree Lessons I've been studying. The day I sent for them was a golden one for me."

EXACTLY WHAT IS ASTARA?

Astara is a center through which the mystical essence of all religions and philosophies is published for you to study along with members in 64 countries.

It's a school of the Ancient Mysteries where the wisdom of the ages is related to your personal needs in today's world.

It's a center of psychic research, a producer of aids to mystical meditation, a source of ideas and concepts for creative achievements and material accomplishments in the world.

In brief, your search for meaning and purpose, and the answers to troubling and puzzling questions, may very well find its reward at Astara.

Examine this possibility for yourself by sending for the free booklet *Finding Your Place in the Golden Age.* Learn how you can answer your own important questions. And those of your family and friends. To find a more rewarding life, send the coupon below.

ADV. 5G

Robert and Earlyne Chaney, Directors
ASTARA Foundation SDE
261 S. Mariposa Avenue
Los Angeles, Calif. 90004

Kindly mail me free booklet "Finding Your Place in the Golden Age." I, too, seek a richer, fuller life.

Name_____

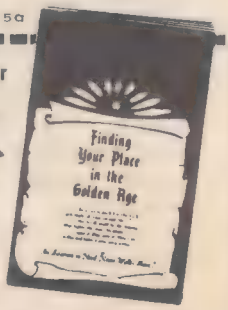
Address_____

City_____

State_____ Zip_____

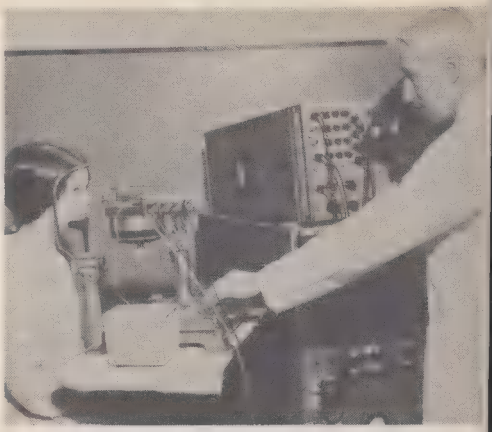
Send Coupon for your free copy now

Astara
FOUNDATION
(NON-PROFIT)
LOS ANGELES,
CALIF. 90004



"AN ASTARIAN IN NEED NEVER WALKS ALONE"

Measuring eyes with sound waves



Eye measurements are being taken of this girl's eyes by Dr. Ernest Giglio, inventor of the automatic probe applicator and its ultrasonic equipment. A drop of water placed on the cornea transmits ultrasonic waves to the eye and the echoes returned create her eye pattern.

THE OPTOMETRIC CENTER of New York takes eye measurements by sending short pulses of sound into the eye and measuring the time required for the echoes to return. These measurements can now be made in just a wink—literally within the normal blink reflex time of about a tenth of a second.

A soft plastic cone filled with liquid approaches and gently touches the eye to transmit the ultrasonic waves to the eye. The echoes, returning through the liquid, create a pattern that is photographed to record the thickness of various parts of the eye, including the cornea, aqueous humor and crystalline lens.

The measuring instrument, for which Patent 3,453,998 was recently awarded to Dr. Ernest J. Giglio, a research investigator at the center, has been used chiefly to study the eye growth of children from two to 17 years old, but works also with adults. It is expected to aid in diagnosis, indicating, for instance, whether a lump is a tumor or a detachment of the retina, and tracing foreign bodies.

In using the instrument, the optometrist places the end of the transparent probe just beyond the patient's eyelashes and shines a tiny light. The patient focuses the eye being measured on the light and aims the other at a picture. Waiting until after a normal blink, the doctor presses a switch, causing the probe to touch the drop of liquid to the cornea for a few hundredths of a second.

The waves are projected at about 20 million cycles a second, and the rates at which their echoes pass through parts of the eye are known.

Dr. William M. Ludlam, project director at the center, which is a non-profit research and postgraduate institution, commented recently that the automatic applicator had changed ultrasound measurement from a laboratory curiosity to a practical clinical procedure. Before Dr. Giglio's invention, a patient had to immerse his eye in a water-bath, and this was uncomfortable.

—Stacy V. Jones

Three Lions Photos

This premature infant is just a few hours old. It has a good chance of surviving because of a new machine called an "electronic mother," a computerized incubator monitoring system which keeps close tabs on six premature babies simultaneously. The automatic machine keeps track of such vital information as respiration, heartbeat, brain waves, temperature. All information is then transferred to magnetic tapes which are continuously examined by technicians and doctors. If anything should go wrong with the infant, an alarm sounds and the infants get immediate, specialized attention. Because of this continuous care, the premature infant death rate may be lowered by large factor.

Incubating babies by computer

THE FIRST FEW DAYS of a premature baby's life are the critical ones. Because the infant has been born before it is really out of the fetal stage, it is vulnerable to an army of complications.

For instance, the respiratory system may not be sufficiently developed to allow the infant to breathe unassisted the way a full-term baby can. Also, the heart and circulatory system of a premature infant must be monitored constantly in those first important days. The possibility of brain damage due to oxygen shortages and other birth complications is always present.

Then there are the usual routines such as feeding, changing diapers and making umbilical cord examinations that are always required—premature or full-term. But how is it possible to give the infant all this attention and still maintain the regular routine in the obstetrics ward?

The Center for Biological Research of the Newborn at the Port Royal Hospital in Paris may have the answer. Doctors there are using a machine nicknamed the "electronic mother." What it really is is an automatic incubator monitoring system which simultaneously records the respiration, temperature and heartbeats of six incubator babies. These records and the results of all tests, including electrocardiograms and electroencephalograms, appear on magnetic tapes which are constantly examined by doctors and technicians.

The babies are also watched continuously via closed circuit television. All treatment and procedures, including feeding, scalp and umbilical cord examinations and electroencephalograms, can be done without moving the infant from his incubator.

With this kind of care, the chances of a premature infant's surviving are boosted considerably. ■

These technicians are observing the automatic monitoring system of the "electronic mother" as it simultaneously records the respiration, temperature and heartbeat of a premature infant. The technician at right is also checking the baby via a closed circuit television system.

A Java safari—by camera

Java Diary. Eliot Elisofon. Macmillan. ($9.95)

Besides being an exceptionally fine and human account of a fascinating expedition through primeval jungle, this book is a genuine "bible" for anyone who has ever wanted to know the techniques and tricks of photographing wild animals at home in their natural state. The price may be a little steep, but it's worth every penny.

Eliot Elisofon is one of *Life* magazine's most renowned, traveled and ubiquitous photographers. The sprawling rooms of his New York apartment look like some forgotten wing in the Museum of Natural History, with hand-carved primitive statuary, Watusi spears and shields, Zulu headdresses and knicknacks from Borneo, Angkor Wat, Peru and every far corner of the planet you can imagine. He has written a number of books—all of them instructive and interesting (he is a born teacher)—but this one really does it for the hopeful photographer of nature in the wild. In his daily accounts of progress through the dense jungles, he details the technical aspects of photographic rehearsals for the pictures he wants to get. He lists his lenses and cameras, reveals how they are used, the films he employs and why, the techniques of setting up blinds, the tricks used in baiting and waiting for the subjects.

But don't think this is just a photographer's handbook. The author was sent to Java to do a photo essay for *Life*, and the book is a lucid adventure story of the expedition's search for the rare fauna of that Indonesian island—banteng, the almost extinct one-horned Java rhino, giant monitor lizards, the mouse deer (it's a foot high), the great herons and egrets. If you want to know how to mount such an expedition, it's all here—right down to the problems with officials who'd like to "lay it on" for you in true "American" style (for only $30,000, you can have the ship cart you up the river). The author explains how he cut it back to boats and porters, trimmed the bill to a quarter the cost and managed to keep everyone reasonably happy. You'll chug up jungle-enclosed rivers, sit in treetop blinds, bleed from incisions cut by rattan thorns as you sweat your way through the tangle of forest floor.

All told, this is a book you don't just read. You live through it with the author.—*RFD*

Other new books of interest

The International Atlas. Rand McNally. ($35.00). Rand McNally has gone to a great deal of expense ($3,000,000) and time (10 years) to produce this volume of "maps at their finest." Truly an international atlas in scope, the 556-page book is written in four languages and was compiled through the efforts of people from 14 different nations. The atlas has one definite drawback, however. Because of its great detail and wide assortment of maps and thor-

ough index, it's actually somewhat difficult to find what you're looking for. It's excellent for detail work, but you wouldn't need it to locate your favorite resort.

The Year of the Whale. Victor B. Scheffer. Charles Scribner's Sons. ($6.95). The whale has always been one of the most intriguing of mammals, perhaps because it is also one of the most mysterious and least observed by man. This is a fictionalized story based on fact about the birth and first year of a sperm whale, a creature whose numbers are in grave danger today. It's a beautifully produced, written and illustrated book.

The History of the Abacus. J.M. Pullan. Frederick A. Praeger Publishers. ($4.95). Anyone with an interest in mathematics will find this an intriguing book, and while the book is a bit on the dry side, it's loaded with facts, figures and many illustrations.

A Walk Through Britain. John Hillaby. Houghton Mifflin. ($5.95). On this delightful 1,100-mile journey by foot through Britain, the reader will get to know the charming characters Mr. Hillaby met, experience the cold, wet mornings so common in Britain and enjoy the great stone fences and scenic beauty of rural England. It's a pleasant journey and an educational one.

The Soul of the Ape. Eugène Marais. Atheneum. ($5.95). Written many years ago but undiscovered until just recently, this book deals with the humanness of the higher primates—especially baboons. Marais, a poet-natural scientist who died in 1936, vir-

tually lived with a tribe of baboons for almost three years, so his observations of their behavior are quite enlightening.

Earth Photographs from Gemini VI through XII. NASA. ($8.00) For sale by the Superintendent of Documents, U. S. Govt. Printing Office, Washington, D. C. 20402. Most of the 327 pages of this fine book are large full-color photographs, and quite beautiful ones at that. It's a collector's item.

Habitats and Territories. Peter H. Klopfer. Basic Books. ($3.95). The use of space by animals and the ecological concepts this entails is what this book is all about. It's the first in a series on comparative psychology, and it's written for the scientist, educator or educated layman.

The Plague Killers. Greer Williams. Charles Scribner's Sons. ($6.95). Here's a well-written, well-documented look at the history of three of the biggest battles against diseases in this country and the world. The three campaigns Williams dramatizes are the fights against yellow fever, malaria and hookworm.

Biology of Mammals. Richard G. Van Gelder. Charles Scribner's Sons. ($5.95). Here's a marvelous compilation of fascinating tidbits about many well-known mammals and some not so well-known. Did you know, for instance, that the polar bear's liver is toxic to man certain times of the year because it is so enriched with Vitamin A? There are plenty more of these facts from a man well backgrounded in this area as chairman of the Department of Mammalogy, the American Museum of Natural History.

Living in Space. Mitchell R. Sharpe. Doubleday. ($5.95). The Astronaut and His Environment, as the book is subtitled, has been brought into the limelight quite dramatically in the recent months. Doubleday has included this glimpse of man in space and preparing for space on earth in its science series. It's complete with many illustrations, a number of them colored. Also in paperback.

Your Heart and How to Live With It. Lawrence E. Lamb, M.D. The Viking Press. ($5.95). This is a rather important topic since heart disease is the number one killer in America,

and Dr. Lamb gives some textbook information on the mechanics of the heart as well as quite a bit of medical advice on how to eat, exercise and enjoy life while taking every precaution to prevent heart trouble. If you're interested in doing what's best for your heart, here's ■ book for you.

Universe, Earth, and Atom: The Story of Physics. Dr. Alan E. Nourse. Harper & Row. ($10.00). In the author's own words, this "is a book of general information written for the intelligent but untrained layman who seeks to understand in clear and simple terms what the current work in modern physics is doing, how it got where it is and where it is now going." It indeed is all that, in 674 pages.

Wallace and Bates in the Tropics. Edited by Barbara G. Beddall. Macmillan. ($5.95). Two self-taught naturalists, Alfred Russel Wallace and Henry Walter Bates, were Charles Darwin's contemporaries and played almost as big a role, though not as well known, as did Darwin in advancing the theory of evolution through natural selection. Barbara Beddall has incorporated writings of the two naturalists about their years spent in South American tropics into an adventurous and educational tale.

Journey to Red Birds. Jan Lindblad. Translated from Swedish by Gwynne Vevers. Hill & Wang. ($6.50). While this is not a vitally important scientific work, it is a truly entertaining and exciting one, due largely to the excellent photographs the author took of the wildlife and scenery of the beautiful Caribbean islands. His journey to the island of Trinidad to photograph its national bird, the ibis, is a real adventure story.

Space: The Story of Man's Greatest Feat of Exploration. Patrick Moore. Natural History Press. ($12.95). From the Greek philosophers' thoughts on space travel to the first science fiction and, most importantly, American and Russian space travel, but not including man's walk on the moon—it's all here in an easy-to-read volume by the British author of 31 books on astronomy. The illustrations are abundant, too. ■

CLASSIFIED ADVERTISEMENTS

Rate: $5.00 for first ■ lines each insertion. $3.00 each additional line. Minimum space accepted is 2 lines, payable in advance. Count 45 characters and/or spaces per line. To be inserted under the proper classification, copy must be in our office by the 1st of the second month preceding date of issue. **The next available issue to place an advertisement in Science Digest is December, 1969. The closing date is October 2, 1969. Send remittance and order to: H. K. Esposito, Classified Advertising Manager, Science Digest, 575 Lexington Avenue, New York, New York 10022. Please make remittance payable to Science Digest.**

SCIENCE & CHEMISTRY

3D-Chess rules $2, U.S. — Canada 3D-Chess Club $2/yr. 3D-Chess boards plexiglas $20, other $10. Box 4277, Hampton, Va. 23364.

VAST converging stellar energies hit atoms, push-in-then-out, and cause gravity. Summary 25¢. Carnahan, 2007 Eaton Lane, Austin, Texas 78723.

UFO Detectors, photos, books, magazines. Catalog 25¢. Paradice, 290 Washington, Vidor, Texas 77662.

VORTEX atom booklet with 1967 supplement and 1968 leaflets, abundantly illustrated by diagrams of new atomic and chemical structures for solving previously unsolved or incorrectly solved problems such as the duality of particle and wave, the benzene ring structure and the transition from the nonliving to the living. $1.00. C. F. Krafft, 4809 Columbia Rd., Annandale, Virginia, 22003.

ELEMENT No. ■ not Atomic No. Z. $1. to V. Waage, 707 E. 6th St., Duluth, Minn. 55805.

MARTIANS could invade any moment! Be prepared! Build your own UFO-Detector. Plans only $1.00. Electric Motor kit complete with instructions, only $1.00. Giant Chemistry, Astronomy, Biology catalog, 35¢. Free gifts with order. Xercon Scientific, 8542 Oglesby, Chicago, Illinois 60617.

ATOMIC structure in relation to the benzene ring problem. A 4-page folded leaflet for two dimes. C. F. Krafft, 4809 Columbia Road, Annandale, Virginia. 22003.

FREE Periodic Classification of Elements and Conversion Tables With Catalog 35¢. Chemicals. Apparatus, Biology. Mid-States Scientific, 7053 N. Clark, Chicago, Ill. 60626.

GRAVITY Solved, by Sub Atomic Spectron c theory. $1. to Ca-Nook, R3, Newfield, N.J. 08344.

LASER pistol—$1.00, how to build. Phaser Pistol $1.00, you've seen it on TV, now build your own. . . . safe, loads of fun. Build Laser rifle, electronic Laser, Flying Saucer—$4.95 each. Add 25¢ for postage. Complete catalogue prize-winning science projects—25¢. Roy Davis Laboratories, Dept. SD, 118 West Adams, Jacksonville, Florida 32202.

300 Page Chemical & Apparatus Catalog $3.00. Laboratory Materials, 1330A Hyde Park, Chicago 15.

MOLECULAR thermodynamic paramagnetic gas drive concept and other free power ideas. Free examination. Return or remit $1. 1616 S. Compton, SD8, St. Louis, Mo. 63104

FOR INVENTORS

INVENTIONS, Ideas—Searched—Developed—Marketed, formerly: United States Government Patent Examiner. Advisor, Raymond Lee, 75-N East 45 St., N.Y.C. 10017.

INVENTIONS WANTED

INVENTORS! Sell your invention for cash or royalties! Our client manufacturers eagerly seek new items. Patented. Unpatented. Financial assistance if needed. 25 years proven performance. For free information, write Dept. 24, Gilbert Adams, Invention Broker, 80 Wall St., New York, N.Y. 10005.

INVENTORS! Don't sell your invention, patented or unpatented, until you receive our offer. Eagle Development Company, Dept. J, 79 Wall Street, New York 5, N. Y.

INVENTIONS Wanted. Patented, unpatented. Global Marketing, 2420-AC 77th, Oakland 5, Calif.

TREASURE FINDERS

ULTRA-Sensitive and powerful metal detectors-join the many who are finding buried coins, minerals, relics and artifacts. Don't buy till you see our free catalog of new models. Write Jetco, Box 132, SD, Huntsville, Texas 77340.

TREASURE Hunters! Prospectors! Relco's new instruments detect buried gold, silver, coins. Kits, assembled models. Transistorized. Weighs 3 pounds, $19.95 up. Free catalog. Relco-A88, Box 10839, Houston, Texas 77018.

FIND Buried treasure with new revolutionary analytical metal detector. Features push button tuning, automatic tuning, loudspeaker, negligible ground pickup, greatest range. Free catalog. Gardiner Electronics, Dept. 59, 4729 N. 7th Ave., Phoenix, Arizona 85013.

"GOLD, SILVER, RELICS! Located with powerful Detectron metal detectors. Free information. Terms. Detectron, Dept. 10-SD, Box 243, San Gabriel, Calif. 91778.

BOOKS, PERIODICALS

TWILIGHT of Evolution. $1.50 Is Evolution the answer? $1.25. Christian Evidence League, Malverne, N.Y. 11565.

ASTONISHING Self-Development book sale. Many new success secrets to open your door to Power, Riches, Health, Happiness. Free catalog-bonuses. Don Lenzi, Box Z21A11, Beverly Hills, Calif. 90213.

MY World of Astrology by Sydney Omarr. $2.00 Shamrock Sales, 2401 Banner, Dearborn, Michigan 48124.

BACK Date Magazines! Send needs. No catalog. Midtown Magazines, Inc., Box 917-SD, Maywood, N.J. 07607.

KNOW More about the earth you live on. Earth Science, bimonthly Magazine, Box 550S, Downers Grove, Ill. 60615. Subscription $2.50. Sample 35¢.

BOOKS Located—any subject. Hoffman Research Service, 124-K Whitmore Road, Irwin, Pa. 15642.

"SECRET of Achievement" will help you find power and success in your life. $3.95 Ten day money back guarantee. How To Company, Box 4920, El Paso, Texas 79924.

OUT-OF-PRINT. Technical: any subject. State needs. Enclose 6¢ stamp. John Roby, 3703C, Nassau, San Diego, Calif. 92115.

PUBLISH Your book! Join our successful authors: publicity advertising, promotion, beautiful books. All subjects invited. Send for free manuscript report and detailed booklet. Carlton Press, Dept. XST, 84 Fifth Avenue, New York 10011.

BOOKPLATES

FREE Catalog—Many beautiful designs. Address Antioch Bookplate Co., Yellow Springs 13, Ohio.

EDUCATION & INSTRUCTION

HIGHER Income, Security and power. 256 page book "Thinking Big" Reveals secrets that make men rich! Send $2.00. Nat-Co., 907 Vandalia St. Collinsville, Illinois 62234 SD.

SPEAK Spanish. New Method based on similarity to English. 48 page booklet 60¢ prepaid. Spanish, Box 1, Congress, Arizona 85332.

EARN College or High School diploma at home. All subjects. Free brochure. Ohio Christian College. 1156 Striebel Road, Columbus 13, Ohio 43227.

EXPERIMENT With sleep-learning! Fascinating, educational. Use your recorder, phonograph or amazing new Electronic Educator endless tape-recorder. Astonishing details, huge catalog of tapes, records, equipment free! Sleep-Learning Association. Box 24-SD, Olympia, Washington 98501.

EARN A British diploma in Radionics, Botanic medicine, Homoeopathy, Super-Science, Divinity, Philosophy. 35 courses, prospectus free. Brantridge Forest School Highfield, Dane Hill. Haywards Heath, Sussex, England.

EXPERT Penmanship complete course $1.00. Framar, 9 Disney Dr., Toms River, N.J. 08753.

LEARN Handwriting analysis. International, Dept. SD. 11749, Eldridge, Lake View Terrace, Calif. 91342.

BE a Real Estate Broker. Big earnings. Prepare quickly, easily. GI approved. Free catalog. Weaver School, 3519-A3 Broadway, Kansas City, Missouri 64111.

LEARN Civil and criminal investigation at home. Earn steady, good pay. State age. Institute Applied Science, 1920 Sunnyside, Dept. 28A, Chicago, Illinois 60640.

BECOME an electronics technician. Earn your FCC (Federal Govt) license; then make high pay. We train you by home study. Free details. Write: Dept. D-9, Pathfinder School of Electronics, 1505 N. Western Av., Hollywood, Calif. 90027.

COMING: Total tax maximum-2%! Membership $1.00—Write: Atom, 2505-07 36th, SePlace, D. C. 20020.

7 DAYS To Faster Reading. Remarkable Book $2.00 Shamrock, Dept. 1, 2401 Banner, Dearborn, Mich. 48124.

GOVERNMENT SURPLUS

JEEPS Typically from $53.90 . . . Trucks from $78.40 . . . Airplanes, Typewriters, Boats, Clothing, Camping, Sporting, Photographic, Electronics Equipment. Wide variety, condition. 100,000 Bid bargains direct from Government Nationwide. Complete sales directory and surplus catalog $1.00 (Deductible First $10.00 order). Surplus Service, Box 820-SD, Holland, Michigan 49423.

MAKE Money on government surplus. How and Where to buy. Directory of surplus offices. Sale terms. Mail order items. Send $1.00, Morgan Gifts, Dept. SD, 231 East Union St., Medina, Ohio 44256.

REAL ESTATE — FARMS

FREE . . . 252-page FALL-WINTER CATALOG! Describes and pictures hundreds of farms, ranches, town and country homes, businesses coast to coast! Specify type property and location preferred. Zip code, please. United Farm Agency, 612-SD W. 47th St., Kansas City, Mo. 64112.

HORSES, LIVESTOCK

"HOW TO TRAIN HORSES" — Everyone who likes horses or ponies should have this book; FREE. Write Beery School, 25910, Pleasant Hill, Ohio 45359.

PETS, BIRDS, CATS, HAMSTERS, ETC.

BABY Raccoon, Skunks, Monkeys, Fox and all other animals. Send $1.00 for price list. Slocum, Box 30-15, Grove, Oklahoma 74344 — Telephone 918 786-2201.

LIVE SEAHORSES, marine specimens aquarium supplies. Illustrated catalog 15¢. Marine, Box 248-304, Dania, Fla. 33004.

RABBITS—FUR BEARING ANIMALS

RAISE Rabbits for us on $500 month plan. Free details. White's Rabbitry, Mt. Vernon, Ohio 43050.

MAKE BIG MONEY raising chinchillas, rabbits, guinea pigs for us. Catalog — 25¢. Keeney Brothers, New Freedom, Pa. 17349.

FISHING, TACKLE, LURES

CUSTOM made field tested "Lameye" Twin spinner fishing lure. 4 models. Circular free. Fred Doetzel, 1924 First Ave., N.E., Cedar Rapids, Iowa 52402.

NITE Bite-lite notify you of a fish bite. $3.95 p. .15¢ No C.O.D. E. Nichols, 1135 Delaware, Berkeley, Calif. 94702.

HOBBIES & COLLECTIONS

SEASHELLS Worldwide price list free. Book, 790 color pictures $1. Box 13288, Tampa, Fla. 33611.

ANTIQUED Historical reproduction documents free list. Dick Longenecker, Rte. 1, Box 735-1AS, Annville, Penna. 17003.

MODELS—SHIPS, TRAINS, PLANES, ETC.

ROCKETS-Flying models-engines-igniters. News-A-Log 25¢. RDC, Route 3-D, Seymour, Ind. 47274.

COINS, TOKENS, CURRENCY

COLLECT Coins for profit, How to start, Where to sell, lists of valuable coins check your change. Send $1.00, N. Martin Haggstrom Co., Dept. 2, 627 So. Jackson St., Batavia, Ill. 60510.

COLLECT Coins for profit! How to start, Where to sell. Lists of valuable coins. Check your change! Send $1.00, Dept. 78, A.M. Pelkey, 36 Milton Dr., Monroe, Michigan. 48161

STAMP COLLECTING

121 DIFFERENT flag stamps free, W-B Stamp Co., Wilkes-Barre, Penna. 18703.

6 DIFFERENT gold coin stamps $1. with exotic approvals. Bick, Box 46695B, Los Angeles, Calif. 90046.

FREE Stamps send 20¢ postage handling. T. Snyder, 115 E. 3rd. St., Los Angeles, Calif. 90053.

ARTS AND CRAFTS

SILVER, gemstone & metal jewelry craft taught by mail. Tools & materials. Details free. Craft Training Inst. 7438 S.E. 40th, Mercer Is. Wash. 98040.

HOME CRAFTSMEN

DIAGRAMS of traps to build at home-$1.00. Harris, 2005 Singing Brook, Austin, Texas 78723.

FOR THE HOME

30 NEW unwoven cotton and rayon towels 18" x 12" $1.45. Koch Mail Order, Cabazon, Calif. 92230

DO-IT-YOURSELF

WATER!! Drill your own well the easy, economical way with amazing new invention. Save 75%. Free information. DeepRock Drilling Co., Opelika, Ala. 36801.

ATHLETICS & BODYBUILDING COURSES

BODYBUILDING questions answered by "Denie's Gym," $5 per 2 by mail. Members get personal attention, Denie's Gym, 719 Bergen Ave., Jersey City, N.J. 07306.

"GIANT ARMS". Dr. Young's. D.C. Revolutionary Discovery. $2 Satisfaction or refund. Gaucho. Box 9309-S. Chicago, Ill. 60690.

COLOR SLIDES

SELL your photos. Report tells How, Where. Color Slide Markets. Only $1.00. The Shirley Shoppe, 17 Rundel Park, Rochester, N.Y. 14607.

MOTION PICTURES & SOUND EQUIPMENT

FREE 64-PAGE CATALOG! All movie needs; Film, supplies, accessories, home processing equipment. Superior, 446-48 N. Wells, Chicago, Ill. 60610.

RADIO, TELEVISION & HAM EQUIPMENT

T.V. & RADIO TUBES .33¢ ea. Send for free catalog. Cornell, 4213 S. University, San Diego, Calif. 92105.

MUSIC AND MUSICAL INSTRUMENTS

UNIQUE Guitar Course. Teaches chords and melody with 7" record, diagrams, photographs. $1.50 complete. Hayes, 326 Bidney Dr., Burlington, N.C. 27215.

POEMS, songs wanted for new song hits and recordings by America's most popular studio. Tin Pan Alley, 1650-SD Broadway, N.Y. 10019.

SONGS, Poems wanted for publishing, recording at our expense! Talent, 17-S Longwood Road, Quincy, Mass. 02169.

DRINKING WATER PURIFIERS

THE see all water purifier. Write for free folder, Nappanee Water Filter Co., 1058 W. Market St. Nappanee, Ind. 46550. Salesman Wanted.

MAGIC TRICKS

FORTUNE telling cards. These 32 horoscope cards will liven any party. Fortunes are printed right on the cards. Compiled by Zolar, World famous astrologer. $3.00 send to: Cisco's, 1660 Rockwood Drive, Youngstown, Ohio 44505.

1000 AMAZING Houdini Tricks, Stunts, Illusions, Magic!! Giant 164 page Catalog!! Unique! Startling! Only 25¢ with Free Gift Certificate. House of 1000 Mysteries, Dept. SD69, Ft. Lauderdale, Florida 33308.

FREE! World's leading catalog 2000 Novelties, Jokes, Tricks, Scientific Gadgets, Hobbies, Sports, Jewelry. Johnson-Smith, D550, Detroit, Michigan 48224.

NOVELTIES

32 HOROSCOPE fortune telling cards guaranteed to liven any party. Compiled by Zolar-World famous astrologer. $2.98. North Star Sales, 224 Aurora Lane, Circle Pines, Minnesota 55014.

GIFT SHOPPING

FREE gift catalog with free gift offer. Box 4237-R, Muskegon Hgts., Michigan 49444.

NEW handsome chronograph watch for pilots, sportsmen, anyone. 6 dials, 5 hands, 2 pushbutton control—$12.95, guaranteed. FREE catalog. Over 100 other useful items. Edward W. Davis, 1260 So. Beverly Glen, Los Angeles 90024, Calif.

FLOWER-of-the-Month pin $2.95 & 35¢ post state no. Hank Zamora, 1501C Dolores NW, Alb. N.M. 87105.

FREE Catalog featuring unusual and useful gifts. Thelco, 722 Keller, Westwego, La. 70094.

CHRISTMAS GIFT SHOPPING

DOODLE desk for the kids. Large roll of paper provides hours of fun. Uses shelf paper from local super-market. Only $4.25, no C.O.D.'s, please. Send for our free catalogue of distinctive gifts. The Shirley Shoppe, 17 Rundel Park, Rochester, N.Y. 14607.

FREE Christmas gift catalog. Write to Dept. SD, JayJay's 165 Beech St., Eastchester, N.Y. 10707.

AUTOMOBILES

1969 FORDS, Dodges $999, 1968 cars only $799. Send for free catalog. Associated Auto Dealers, 50 Swalm St., Dept. 7, Westbury, New York 11590.

AUTO TRAILERS

PICKUP Camper, Trailer or Pickup-Cover. Build Yourself. Save! Complete plans $3.95 each. Cover plans $2.00. Conversion plans-econoline type van $2.95; passenger bus or delivery van $2.95. Satisfaction Guaranteed. Equipment catalog $1.00 (refundable). Details 10¢. Viking Camper Supply, 99-H Glenwood, Minneapolis, Minn. 55403.

BATTERIES, GENERATORS

POCKET Solid State trickler-charger, battery full charge at all times wt. 3 oz. $5.25 ea. Details free. McCurley & Co., Drawer 16505, Mobile, Alabama 36606.

ELECTRICAL SUPPLIES

LO-VOLT circuit tester. Handiest ever. Free Info. Write: Matheo, 4256C Minmor, Cinn. Ohio 45217.

BUY IT WHOLESALE

WHOLESALE 1970 auto price book saves money!! Shows dealer cost on 565 U.S. models, extras. $2.00. Kar Kost, Box 22493, Houston, Texas 77027.

REMAILING SERVICE

CHICAGO, Milwaukee, Indianapolis, Wausau prompt reliable. Free information and color postcard included. Jay's, P.O. Box 1301, Wausau, Wis. 54401.

MAILING LISTS

MAILING list opportunity seekers 1000 — $1.00 Guaranteed. Holden, P.O. Box 962A, Bellflower, Ca. 90706.

SPECIAL SERVICES

RELAX! Always tense and on edge? Nervous and irritable? Dr. Gutwirth's 114 page book, "You Can Learn to Relax", reveals how to avoid stress and attain complete relaxation in a short time! Only $1.00. Merritt House, 126 Bergen Terrace, Cresskill, New Jersey 07626.

RUBBER STAMPS AND OFFICE SUPPLIES

SIGNATURE rubber stamp knob handle send copy $2 ppd. Rainbows End, 911 145th, Seattle, Wa. 98133.

PRINTING & SUPPLIES

100 8½ x 11 LETTERHEADS $1.50. Envelopes #10-$1.25. 250 each $6.75 ppd. Premier Press, Box 2453, Sacto, Calif. 95811.

GUMMED LABELS

1000 ADDRESS Labels $1.00, very special any name address, zip, 3 lines padded gummed include 10¢ post & hadg. No limit 50¢ total ea. set. Charlo 8313 Stevenson Rd. 1K, Baltimore, Md. 21208.

SALESMEN, DISTRIBUTORS

GET World's largest wholesale Import-Merchandise Catalog. Free facts. Northwest, Medina, Wa. 98039.

AGENTS WANTED

SEND $1 for fastest selling ad specialty line. Rocket Ad Co., Rt. 7, Fayetteville, Arkansas 72701.

HELP WANTED

AUSTRALIA Wants you! Government assisted passage. Unlimited opportunities. Latest government information and forms $1.00. Austco, Box 3623-P, Long Beach, California 90803.

PROFITABLE OCCUPATIONS

BECOME A mortgage broker. Earn 10,000 to 50,000 year. Complete details. United Mortgage Co., P. O. Box 2684-SD, Marietta, Georgia 30060.

PROVEN Moneymakers professional instruction booklets "Writing Fillers" "Sell Your Photos" "Gov't Surplus" "Mailorder Imports" "Sell Coins" $1.00 each. Mountain Mart, 230 S. Sierra Madre St., Colorado Springs, Colorado 80903 Dept. SD10.

MONEYMAKING OPPORTUNITIES

NEW Moneymaking mail order catalog send 25¢ to: Fitz, 275 Main St., Freeville, New York 13068

HIGHER Income, security and power 256 page book "Thinking Big" reveals secrets that make men rich! Send $2.00. Eileens Gift Shop, 829A Western Ave., Zanesville, Ohio 43701.

$10 DAILY writing short articles. Begin immediately! Copyrighted report reveals details Send $1.00. H.M. Sallee, Dept. S, 1131½ So. Grand East, Springfield, Illinois 62703.

MAKE Money on Government surplus. How and where to buy. Directory of surplus offices. Sale terms. Mail order items. Send $1.00 to: Handy House, 7528 Glardon, El Paso, Texas 79915.

ADDRESSERS and Mailers needed. Send stamp for information. Lindbloom Publishing, 3636 West Peterson, Chicago, Illinois 60645.

SELL Your photos. Report tells how, where, color slide market. $1.00. Reuben Martel, Dept. SD104, Medina, N. Dak. 58467.

MAKE 100% — 500% Profit selling easy to sell household products-gifts-toys-novelties-etc. Send $2.00 for catalog & list to: Erber's, Whol. Dist., 1207 Carol Crest Dr., Dundee, Ill. 60118.

BIG profits in becoming a supplier to Major Industry through electroplating small parts and metalizing non-metallics. Write for free particulars: Mason, 1512 Jarvis, Room CM-102-C, Chicago, Ill. 60626.

YOU Can make 2 to 3 times your cost on hundreds of products. Gift items, novelties, toys, carded merchandise, 1001 others. $1.00 brings giant catalog, refundable on first order. Send to: The S & S Co., Box 185, Azusa, Calif. 91702 Dept. C.

MAKE Money with your camera. Over one million photos and color slides are bought by newspapers and magazines every year. Learn what kind of photos they want how to submit them, how much they pay. Let your camera provide a second income. Booklet includes directory of where to sell pictures. $1.00. Snively's, Delaware Ave., Delmar, N.Y. Dept. SD-1, 12054.

$10 DAILY writing short articles at home. Copyrighted report reveals how and where. Send $1.00, name, address for booklet MO51F to: Oceanview House, 4382 Hill St., San Diego, Calif. 92107.

HIGHER Income, security and power, 256 page book "Thinking Big" reveals success secrets. Only $2.00. Mailtown, 33-A Lincoln Avenue, Livingston, New Jersey 07039.

BUSINESS OPPORTUNITIES

HOW To sell books by mail for fun & Profit $3. Owen & Associates, 715 G St., N.W., Wash. D.C. 20001.

CLIP Newspapers for profit! Book reveals how. $2.00, Wacholtz; Box 107, Englefeld, Sask, Canada.

OPPORTUNITY '69 Big earnings at home increase income now 25¢. Three Crowns, Box 222, Bayside, N.Y. 11361.

MAIL Baby Catalogs, Imprint, to new mothers. Big Profits! Details $1.00. Krefski, 609 Lee, Plymouth, Penna. 18651.

IMPORT-EXPORT opportunity profitable worldwide, mailorder business from home, without capital; or travel abroad. We ship proven plan, for no risk examination. Experience unnecessary. Free details. Mellinger, Dept. C187A, Los Angeles, 90025.

$50,000 A Year very possible in mail order imports, a home operated cash in advance business. World-Traders digest and dropship method revealed. Experience unnecessary, start business day instructions. Arrive no investment in merchandise booklet tells you how. Send $1.00 nothing else satisfaction guaranteed, no C.O.D.'s. The Oakton House, 741 Elmhurst Road A, Des Plaines, Ill. 60016.

PEACE, Power & Plenty is your heritage. Possess it now. Details free. Mavis Associates, 2205-S So. Troost, Tulsa, Oklahoma 74114.

WHEN Answering classified advertisements, don't forget to say you saw it in Science Digest.

Letters to the Editor

Rumors, rumors everywhere

Dan Cohen's "The sky is falling—but don't duck," will probably draw enraged mail from every quarter. His sources perplex me. Perhaps he came across some old and unreliable cultist book of some sort and lifted his material from that. Certainly he didn't bother to do any research.

The Icarus fracas began when an Australian college professor soberly announced that there was a chance that the asteroid would strike the earth. His statement was widely published and created the first wave of concern. Hot on the heels of this irresponsible "scientific" revelation came the announcement that M.I.T. was making plans for a rocket launch designed to divert the course of the asteroid. The fact that it was merely a class project was, indeed, pointed out in the newspaper articles, but the paranoids regarded that as nothing but a cover-up. These two articles, both from reliable sources, both carried by the New York *Times* and other major newspapers, created the Icarus scare. So don't blame prophets and doom-sayers.

JOHN A. KEEL
New York, N.Y.

Author's reply

Your comment about my research is a rather unkind cut. Actually the Richardson article was, I believe, the

first public mention of Icarus. The scare was helped along by the Vatican Observatory hoax—both of which were mentioned in my article. The M.I.T. announcement came a year or more after the scare had already started. I don't know about an Australian college professor who announced that there was a chance that the asteroid would hit the earth, but I don't doubt it for Richardson had already said about the same thing. If the prophets and doom-sayers wish to take the reasonable speculations of scientists, and twist them and use obvious (and immediately exposed) hoaxes as facts, then I fear they are to blame for creating the scare.

Daniel Cohen

Tranquilizers and the law

In "The perils of pill-popping with mood drugs" (July 1969), Mr. Gottschalk passed very lightly over a point which I feel should have been expanded. One of the effects of some of these drugs is to induce in the user a willingness to accept situations he would find intolerable otherwise. The same effect also tends to make the user susceptible to suggestions from others—this, in turn, making the user vulnerable to suggestions from hostile sources.

In the last five years, we have encountered a rapidly increasing number of cases in which a man involved in some type of litigation has been given "tranquilizers" by a physician to relieve the extreme tensions that typically accompany legal conflict.

While under the influence of this medication, the patient "signs his life away" in pre-trial agreements. Present law does not recognize the effects of these drugs and provides for no relief, once the agreement is actually

signed by the persons involved.

Attorneys and doctors disclaim individual responsibility and point accusing fingers at each other.

EUGENE AUSTIN, Chairman
Missouri Council on Family Law
St. Louis, Mo.

Another Odyssey theory

I have still another theory about the ending of "2001: A Space Odyssey" (*Science Digest*, May 1968).

After Dave Bowman views the lighting effects he finds himself in a room where he becomes an older man, then a dying man on his death bed, then an unborn fetus. Now, what are the stages of life? Conception to birth to the going through age to death. He seems to be reborn. For what? The simians at the start of the film got their push toward civilization because of the monolith teaching them to use violence constructively. My theory is that man will have gone so far technologically and in intelligence that he will have no farther to go, so he reverts to the beginning—violence, but not exemplified in nuclear war. Bowman symbolizes this reversion, and, since he has more time to live, will see it from beginning to end.

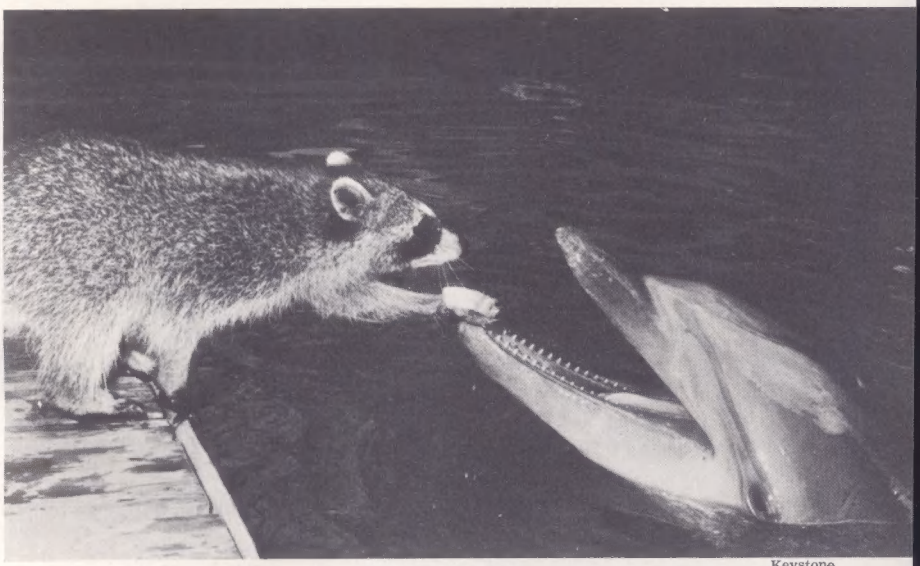
KEN MARKS
Niles, Mich.

Gold guppies—not drab olive

I have 300 golden flamingo guppies that prove writer George P. Nicholas ("Guppies—the amazing millions fish," May 1969) was mistaken when he said that baby guppies are born "uniform drab olive." These guppies were born gold colored, and they have remained gold all their lives. They are yellow gold, not an orange gold like the goldfish (carp).

MARGILEE JOHNS ROZELL
Tyler, Texas

You are right. Not all guppy fry are olive drab.—Ed.



Keystone

Wann'a bite?

RACCOONS don't feed dolphins of their own volition—it simply doesn't occur in nature. But conditioned response *can* produce some pretty weird behavior in animals. You can teach a pig to do a dance, a chicken how to count, a goose how to play the drum, a rabbit how to play the piano. There's a farm, in fact, in New York State where trainers specialize in conditioning farmyard animals to behave in human-like ways. The November issue of Science Digest will carry a picture story on the psychology of conditioning animals to perform.

This raccoon is feeding a dolphin because his owner taught him how through conditioning. They were visiting the seaquarium in Miami, Fla., when the raccoon was photographed in what appears to be amazing behavior.

The first human born on Mars was a "grok" specialist!

THAT was the greatest weapon in Valentine Michael Smith's arsenal . . . a secret that made him irresistible to women but a bitterly hated enemy to the establishment. And all he wanted to do was reform an immoral, troubled world by bringing it peace and tranquility. Some reform! Some revolution! But that's why Robert Heinlein's best-selling classic STRANGER IN A STRANGE LAND is fast becoming the number one underground novel on virtually every college campus in the country. Now take it, if you wish, as one of your 3 introductory books for only $1 with trial membership. Send no money—mail coupon today!

The Science Fiction Book Club invites you to take

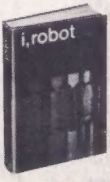
Any 3 SCIENCE FICTION BOOKS for only $1

when you join and agree to accept only four books during the coming year.

Out of This World Entertainment

You are invited to explore the breath-taking world of Science Fiction now, under this trial offer. Take any 3 volumes on this page worth up to $23.40 in original publishers' editions for only $1.00 with trial membership.

Each month new club selections of fiction and fact are described to you in advance. Though these volumes sell for $3.95, $4.95 or more in original publishers' editions, club members pay only $1.49 plus shipping and handling. (You may choose an extra value selection at a slightly higher price.) Your sole obligation is to accept four books during the coming year. Cancel anytime thereafter.



622. The Foundation Trilogy, by Isaac Asimov. The ends of the galaxy revert to barbarism. Pub. ed. $10.50

623. 2001: A Space Odyssey by Arthur Clarke. 5 men and computer trigger cosmic "booby trap". Pub. ed. $4.95

601 I, Robot, by Isaac Asimov. Long out of print. "An enticing thriller."—N. Y. Times. Pub. ed. $3.50

639. Omnivore. Piers Anthony. By what trick did the 3 scientists escape Nacre when 18 others failed?

644. October the First is Too Late, by Fred Hoyle. Solar beams play havoc with time on earth. Pub. ed. $3.95

600. A Treasury of Great Science Fiction. 2-volume set. 1,000 pages. Counts as one book. Pub. ed. $5.95

624. 7 Conquests. Poul Anderson. 7 wars in the future . . . nuclear . . . interplanetary. Can Earth survive? Pub. ed. $4.95

605. Nova, by Samuel R. Delaney. Battle between alien worlds — and a desperate race to the sun. Pub. ed. $4.95

618. Dangerous Visions. Anthology of 33 original stories never before in print by Sturgeon, Anderson, others. Pub. ed. $6.95

626 The Lion of Comarre & Against the Fall of Night. Long out of print! Two works by author of *2001*. Pub. ed. $4.75

629. The Illustrated Man. Ray Bradbury. 19 stories. "Intensely real." *N. Y. Times*. Now a hit movie! Pub. ed. $4.50

630. Ubik. Philip K. Dick. Joe Chip was a man from 1992 — so why was he in 1939? And how could his dead friend talk? Pub. ed. $4.50

SCIENCE FICTION BOOK CLUB
Dept. 90-SDX, Garden City, N.Y. 11530

Please accept my application for membership in the Science Fiction Book Club and rush the 3 books whose numbers I have printed below. Bill me only $1.00, plus shipping and handling, for all 3. Then every month, send me the Club's free bulletin, "Things to Come", which describes coming selections. For each book I accept, I will pay only $1.49, plus shipping and handling. Occasional extra-value selections are priced slightly higher. I need take only four books in the coming year and may resign any time thereafter.

NO-RISK GUARANTEE: If not delighted with my introductory package, I may return it in 10 days, pay nothing, owe nothing, and my membership will be canceled.

Print Name _____

Address _____

City _____ State _____ Zip _____

If under 18, parent must sign here. (Offer good in U.S.A. only)

22-S80